

# A REVISION OF THE GENUS *PTYCHANDRA* (LEPIDOPTERA : NYMPHALIDAE)

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## SYNOPSIS

The genus *Ptychandra* (Lepidoptera: Nymphalidae, Satyrinae) is revised and a key to the six known species is given. *P. negrosensis* sp. n. and *P. lorquinii leytensis* subsp. n. are described. The distinctive male secondary sexual characters are described in detail. Biometric data are used to support the conclusions of qualitative taxonomic study, to place doubtful individuals and to discriminate a geographical race not separable by any single diagnostic character. The biogeographic and phylogenetic affinities of the genus and species are discussed.

## INTRODUCTION

THE genus *Ptychandra* Felder & Felder (Lepidoptera: Nymphalidae, Satyrinae) has long been in need of revision. The only works covering most of the genus are those by Fruhstorfer (1908; 1911) which are difficult to follow and often incorrect. The male brands and genitalia which are important diagnostic characters have not previously been illustrated. Capture by the authors (Barlow, Banks & Holloway, 1971) while on the 1965 Cambridge Expedition to Mt Kinabalu, Sabah, Malaysia, of a series of the Bornean species, *talboti*, provided the stimulus for this work. Hitherto, with the exception of the unique holotype of *talboti*, the genus was only known from the Philippines.

The material used in this revision was obtained from the British Museum (Natural History) (BMNH); the Hope Department of Oxford University (UM); the Senckenberg Museum, Frankfurt-am-Main (SMN); the Humboldt Museum, Berlin (MNHU);

the Carnegie Museum, Pittsburg (CM); the Smithsonian Institution, Washington (USNM); and the American Museum of Natural History, New York (AMNH). Additional invaluable material was obtained from the private collections of C. G. Treadaway and J. N. Jumalon whose *Ptychandra* were subsequently donated to the British Museum (Natural History). No *Ptychandra* were present in the Sabah Museum, Kota Kinabalu; the Raffles Museum, Singapore; or the Sarawak Museum, Kuching.

Venation and cell nomenclature follows that in *The Insects of Australia* (C.S.I.R.O., 1970), each cell being designated by the vein anterior to it.

#### ACKNOWLEDGEMENTS

We are deeply indebted to R. I. Vane-Wright and T. G. Howarth of the British Museum (Natural History) for much helpful advice and assistance in the early stages of the work and for criticism of the manuscript. H. Clench of the Carnegie Museum supplied information about the movements of the collector, Lorquin. J. N. Jumalon, University of San Carlos, Philippines and C. G. Treadaway gave us access to their private collections. H. Hayashi kindly sent us photographs of *P. talboti* specimens collected by a colleague on Mt Kinabalu in 1974. The collection of the recent Bornean specimens was made possible through the generosity of a number of funds and companies which supported the 1965 Cambridge Expedition to Mt Kinabalu. The statistical analyses of the biometric data were carried out by N. A. Campbell and A. Grassia of C.S.I.R.O., Division of Mathematics and Statistics. The photographs were taken by P. V. York (BMNH).

#### GENERIC DESCRIPTION AND FEATURES

##### *PTYCHANDRA* Felder & Felder

*Ptychandra* Felder & Felder, 1861 : 304; Staudinger, 1887 : 222; Röber, 1889 : 203; Reuter, 1897 : 122, 553; Fruhstorfer, 1908 : 221; 1911 : 329; Gaede, 1931 : 320; Miller, 1968 : 34, 49; Hemming, 1967 : 388; Lewis, 1973 : 276. Type-species: *Ptychandra lorquinii* Felder & Felder, by monotypy.

DESCRIPTION. ♂. *Facies*. Upperside iridescent blue-purple with small white or bluish markings subapically and antemarginally. Underside light to deep brown ground colour marbled with darker brown, wavy transverse lines in discal area, with additional silver lines in some species. Full series of submarginal ocelli on hindwing underside in cells  $R_s$  to  $1A + 2A$ ; that in cell  $R_s$  often enlarged and inwardly displaced. Forewing underside with two to four submarginal ocelli in cells  $R_s$  to  $M_3$ . *Venation* (Text-fig. 1). Forewing cell approximately one-third length of costa. Vein  $M_3$  colinear with lower discocellular vein. Median discocellular vein slightly angled at origin of  $M_2$ , almost straight between origins of  $M_2$  and  $M_3$ , and meeting lower discocellular, being approximately at right angles. Origins of subcostal and cubital veins strongly swollen at base, anal vein somewhat less so. Hindwing cell closed, about half the length of the wing, with vein  $Sc + R_1$  slightly inflated proximal to the humeral vein. Vein  $M_3$  extended into a well formed tail with subsidiary lobes at terminations of  $CuA_1$  and  $CuA_2$  in some species. On hindwing, origins of  $CuA_1$  and  $M_3$  well separated. *Secondary sexual characters*. Forewing cubital branches displaced by a brand of mealy scales covered with a long black hair pencil placed between  $CuA_1$  and  $M_3$  (except *schadenbergi*) and a pouched

hair pencil present basally between  $CuA_1$  and  $CuA_2$  (except *talboti*) running about one-third of length of wing in the interneural furrow. Hindwing hair pencil present in some species at origin of  $R_s$  overlying part of cell. *Body and appendages.* Eyes hairy. Palpi strongly haired on second segment with third segment approximately one-sixth length of second. Antennae about half length of costa with finely tapered club. Tibial spurs present. *Genitalia* (see Text-figs 2-14). Valvae sclerotized distally, usually with a three-lobed terminal section armed with flat sclerotized plates giving a heavily serrated tip. Exteriorly furnished with many narrow setae often as long as the breadth of the valva and interiorly possessing a few short stiff setae in the sclerotized zone. Tegumen and uncus smoothly tapered with the uncus often notched distally. Gnathos bifid, either smooth or with weakly sclerotized processes and plates on the dorsal surface distally. Posterior ends of gnathos curved upwards (except *talboti*). Aedeagus weakly sclerotized without cornuti.

♀. *Facies.* Upperside light brown with prominent white or off-white markings and broad, white, forewing subapical band. Underside with brown or whitish ground colour traversed

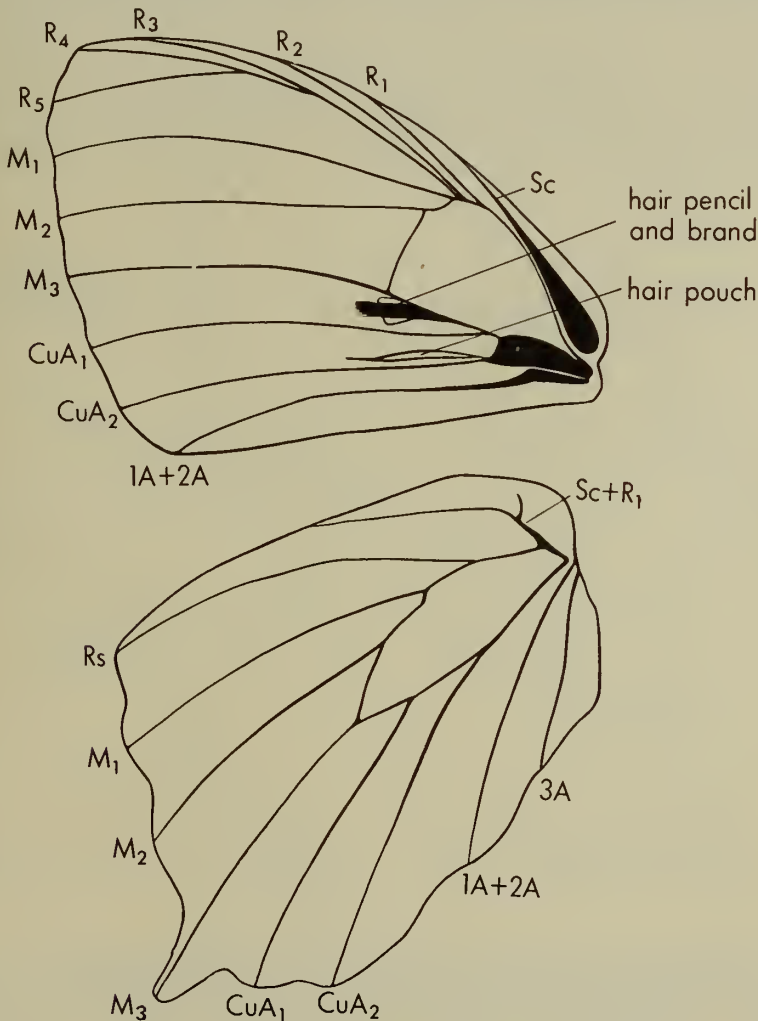


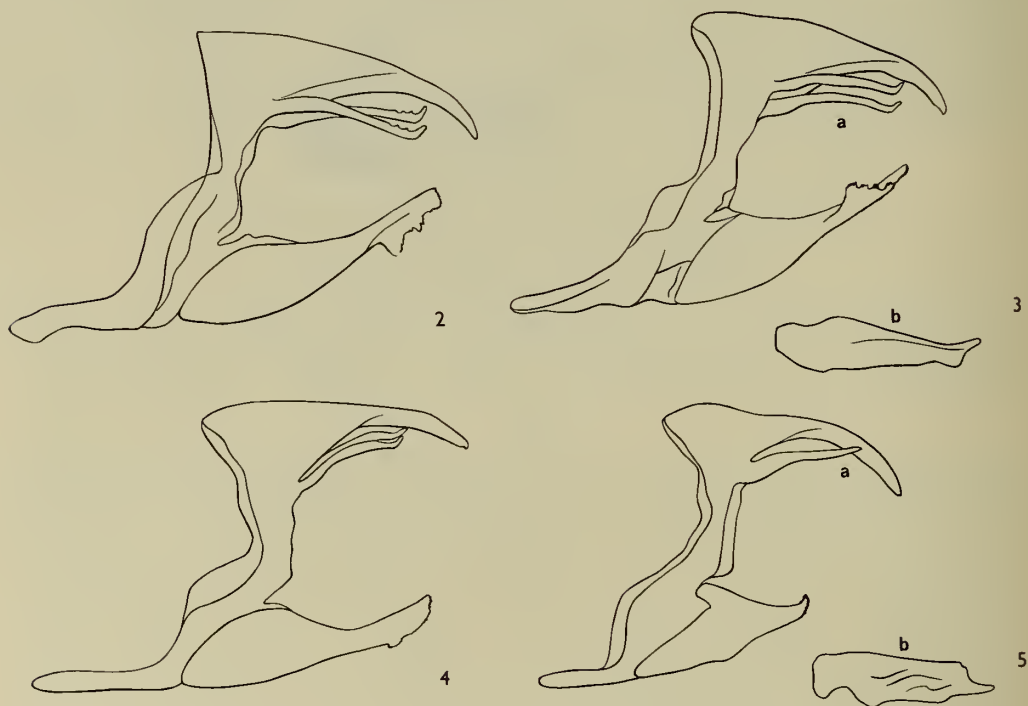
FIG. 1. Venation of *Ptychandra lorquini lorquini*.

by darker brown wavy lines in discal area. Submarginal ocelli similar to male but of increased size. *Venation*. Similar to male, with cubital branches displaced despite absence of brands or pouches. *Body and appendages*. Similar to male but antennae relatively shorter compared with forewing length. *Genitalia*. Outer margin of ovipositor lobes semicircular; posterior apophyses straight, about as long as radius of lobes. Bursa copulatrix equipped with two longitudinal rows of signa.

#### BIOLOGY AND HABITAT

The immature stages are undescribed.

The Philippine species are woodland and forest butterflies found from sea-level to about 700 metres (with a unique record of *lorquini* *lorquini* from almost 2000 metres). They are very much at home in the dappled light of glades and coppices in the forest, tending to avoid full, bright sunlight (Jumalon, in litt.). The males are often seen in numbers in small glades, settling on leaves in the shade and occasionally taking brief flights. Males have been observed to visit bird-droppings and overripe fruit and *negrosensis*, taken in hill rainforest with thick undergrowth of ferns and vines, was observed feeding from cut grass stems in the company of amathusiids and *Neptis* on an overcast day. In Luzon, *lorquini* and *leucogyne* are



FIGS 2-5. Male genitalia of *Ptychandra* species. Left valve removed, aedeagus withdrawn and setation not shown. 2, *lorquini* *lorquini*; 3(a), *schadenbergi*; 3(b), *schadenbergi*, aedeagus; 4, *leucogyne*, ex Luzon; 5(a), *talboti*, ex Mt Kinabalu, Borneo; 5(b), *talboti*, aedeagus.

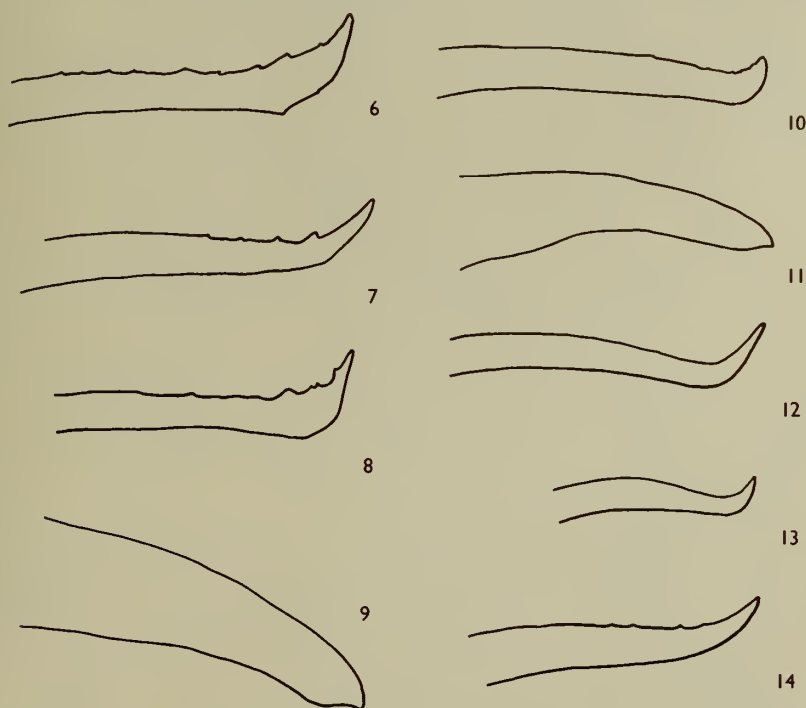


segregated ecologically to some extent, the former being more common in advanced secondary woodland and the latter predominating in mature forest.

In Borneo the Mt Kinabalu specimens of *talboti* were taken at about 2000 m close to primary forest along a road. The Trus Madi specimen was taken close to the summit in moss forest and the specimen of *talboti* from Mt Dulit was also captured in montane forest. This species too is active in overcast weather. The flight habits of *Ptychandra* species appear similar. A female *talboti* was at first mistaken for a riodinid of a genus such as *Zemeros*, which is found in a similar habitat and has similar flight characteristics and colouration. The particular specimen sat on leaves at the forest edge with wings half opened in the sun, making short brisk flights between periods of rest. The larger members of the genus resemble some *Lethe* species in flight, wing pattern, colouration and habitat. There is no record of crepuscular flight for *Ptychandra*, but from this resemblance to *Lethe* it appears likely to occur.

#### BIOGEOGRAPHY AND PHYLOGENY

The genus *Ptychandra* is of great interest as it is one of very few butterfly genera that has undergone considerable radiation within the Philippine island group



FIGS 6-14. Diagnostic details from male genitalia of *Ptychandra*. 6, gnathos of *lorquini* *plateni*; 7, gnathos of *lorquini* *bazilana*; 8, gnathos of *lorquini* *lorquini*; 9, tip of uncus, *mindorana*; 10, gnathos of *mindorana*; 11, tip of uncus, *schadenbergi*; 12, gnathos of *schadenbergi*; 13, gnathos of *leucogyne*; 14, gnathos of *lorquini* *leytensis*.



FIG. 15. Map of Philippines, Borneo and North Moluccas showing distribution records for *Ptychandra* species.

with little radiation elsewhere. Most of the Philippine butterfly fauna has been derived from mainland Asia and areas on the Sunda Shelf, especially Borneo (Holloway & Jardine, 1968; Holloway, 1973). *Ptychandra* is a homogeneous genus with no close relatives and may therefore be considered monophyletic. Speculation on its radiation and speciation is limited by the paucity of material and patchiness of collecting. Some of the locality recording may be in error, such as the record of *leucogyne* from the North Moluccas (Halmahera in the original description and Batjan by Semper, 1889: 60). The recent discovery of *negrosensis* suggests that other islands may yet yield further species.

The Bornean species is morphologically very different from those in the Philippines (size, genitalia and secondary sexual characters) and could be regarded as an early offshoot within the genus. Of the Philippine species four are allopatric and the fifth, *lorquinii*, overlaps with *leucogyne* in Luzon and the central Philippines and with *schadenbergi* in the south (Text-fig. 15). Holloway (1973) suggested a general pattern of two phases of radiation with an intervening period of isolation and fragmentation, caused by changes in sea-level and therefore land area in the Pleistocene, to be responsible for the majority of present day butterfly distribution patterns in the East Indies. The distribution of *Ptychandra* may be open to explanation along similar lines. The allopatric distribution of the Philippine species apart from *lorquinii* suggests the fragmentation of the range of a widespread common ancestor, followed by divergence of the fragments. *P. mindorana*, *negrosensis* and *schadenbergi* are probably still restricted to their original sites of isolation. *P. leucogyne* may have been isolated in the central Philippines and possibly the southern peninsula of Luzon, and *lorquinii* in Luzon. Given such a pattern of isolation, then the present distribution of *lorquinii* and extension north of *leucogyne* in Luzon would have resulted from a second spread phase. This is the simplest explanation of current distribution patterns within the genus. The areas of isolation correspond well with the distribution of land in the Philippines at periods of low sea-level as indicated by Darlington (1957), and the barriers indicated would no doubt have been intensified during periods of high sea-level.

If more weight is placed on the secondary sexual differences of the males, especially those of the forewing hair pencil and associated scale patches, then an alternative hypothesis involving three spread phases could be considered. (1) spread of a generic ancestor over the Philippines and northern Borneo with isolation subsequently in three areas, leading to evolution of brand type (a) (see p. 234 for discussion of brand types) in Borneo, type (b) in the northern Philippines and type (c) in the south; (2) spread of the type (b) ancestor to Mindoro leading to the separation of *mindorana* and *leucogyne*, and spread of the type (c) ancestor north through the Philippines leading to the isolation and development of *lorquinii* on Luzon, *negrosensis* on Negros and *schadenbergi* (where the brand has been lost) on Mindanao; (3) spread of *lorquinii* south to Mindanao and *leucogyne* into the central Philippines. Further collecting in the central Philippines and observations of ecological differences between the species would help to clarify the picture.

The subspecies of *lorquinii*, if one includes specimens from Samar and Bohol with *leytensis* (which they resemble most closely), correspond well with Semper's

(1882) division of the Philippines into biogeographic provinces. The three males of *lorquini* from Palawan are referable to *l. plateni* or *l. basilana* rather than *l. lorquini* and the species is not recorded from Mindoro. The Palawan form must have spread to Palawan via the Sulu Archipelago and north-east Borneo from Mindanao. The distribution of *Eurema alitha* (Felder), widespread in the Philippines and Sulawesi, extending down the Sulu Archipelago to north-east Borneo (Holloway, 1973), suggests that such spread would be possible.

The ecological differences between *lorquini* and *leucogyne* have already been mentioned and it is of interest that *lorquini*, more characteristic of secondary growth, has proved the more dispersive, following the general pattern of greater mobility in secondary growth species indicated by Corbet (1941).

The possibility of the occurrence of character displacement in *lorquini plateni* and *schadenbergi* is discussed in the biometric section.

#### GENERIC AFFINITIES

The genus is of interest as it has proved difficult to place satisfactorily in the higher classification of the Satyrinae. Although usually regarded as an aberrant member of the *Lethe* group (Felder & Felder, 1861; Röber, 1888; Miller, 1968) the genus has characters linking it with other tribes. Miller (1968) suggested that the Melanitini gave rise to the Elymniinae and thus Lethini through steps resembling *Ptychandra* amongst others. *Ptychandra* has the origins of the hindwing veins  $CuA_1$  and  $M_3$  well separated. They are usually connate in the Elymniinae and particularly the Lethini. However, as noted by Fruhstorfer (1908; 1911), many of the characters of *Ptychandra* are associated with the *Mycalesis* group rather than *Lethe*. In particular the prominently swollen bases of the forewing subcostal and cubital veins with the less prominent inflation of the anal vein base (Text-fig. 1) and the secondary male sexual characters are commonly found in the *Mycalesis* but not Lethini. There are structures very similar to the various brands, hair pouches and hair pencils of *Ptychandra* species found in representatives of *Mycalesis* and *Orsotriaena*. The location of these characters is unusual and is also *Mycalesis*-like rather than of the Lethini. The hindwing hair pencil at origin of  $R_s$  is also found in *Mandarinia* (Miller, 1968) and many *Mycalesis* (e.g. *M. perseus*) but not *Lethe* though several of that genus, e.g. *Lethe minerva* F., have a hindwing hair pencil arising just outside the cell with small modified scales beneath it. Reuter (1897) places *Ptychandra* closer to *Neorina* than *Lethe* but within his Lethidi on the grounds of the morphology of the palpi.

Many features are consistent with a close relationship to the genus *Lethe*. The sexes are strikingly dimorphic with the female facies similar to species such as *Lethe europa* F. The wing shape with the slightly falcate forewing and prominent tailing at  $M_3$  in the hindwing is lethine. Except as noted above, and where the secondary sexual wing characters cause displacement, the venation resembles *Lethe*, with the characteristic convexity and relative shortness of the forewing cell. This cell is extremely short in both male and female *Ptychandra*. As in *Lethe*



tibial spurs are present and the female foreleg is pentamerous with spines on the first four subsegments (Miller, 1968).

#### MULTIVARIATE BIOMETRIC STUDY

(written in conjunction with N. A. Campbell,  
C.S.I.R.O. Division of Mathematics and Statistics, Perth, Australia)

The taxa in this study were previously defined on the basis of their differences in qualitative (discontinuous) characters, or on their locality of capture. The males of the *lorquinii* subspecies from Mindanao, Bazilan and Palawan are not readily separable from one another using qualitative (non-metric) characters. The separation of male *lorquinii lorquinii* from *leucogyne* is also difficult.

On inspection there appeared to be a number of distinctive parametric (or quantitative) characters related to the shape, structure and ornamentation of the wing which are possessed by the various taxa. A multivariate approach is adopted in this section to clarify the nature of the morphometric divergence in the wing characters between the taxa.

Genetic divergence between taxa may be reflected in changes in the shape,

TABLE I

Biometric characters and ratios used for statistical analyses

Character No.	Character
1	Forewing length.
2	Forewing breadth. This is taken from the anal angle to the tangent to the costa, crossing the line from apex to origin of cubitus and radius at right angles.
3	Hindwing length, taken from the inner angle of the cell to the maximum extent of the wing close to vein $CuA_1$ , not to the end of the tail at vein $M_3$ .
4	Hindwing breadth, taken from termination of vein $R_s$ to the maximum extent of the wing on the inner margin close to termination of $1A + 2A$ .
5	The calculated ratio of the forewing breadth to length. This gives an index of relative narrowness of the wing.
6	The calculated ratio of the hindwing breadth to length. This was designed to show the interspecific variation in hindwing shape.
7	The perpendicular distance from the tip of the tail at vein $M_3$ , hindwing, to the line joining the maximum indentation in spaces $M_2$ and $M_3$ .
8	Length of forewing lower discocellular vein.
9	Length of forewing lower discocellular vein proximal to the origin of vein $CuA_1$ .
10	Maximum length of hindwing cell.
11	Distance of proximal displacement of centre of ocellus in forewing spaces $M_3$ (usually white-pupilled) from a line running through centres of ocelli in space $M_1$ and $M_2$ . Distal displacements are recorded as negative values.
12	Distal maximum width of outer yellow ring around ocellus in hindwing space $R_s$ .
13	Length of antenna.
14	Maximum length of external hair pencil in space $M_3$ overlying brand.

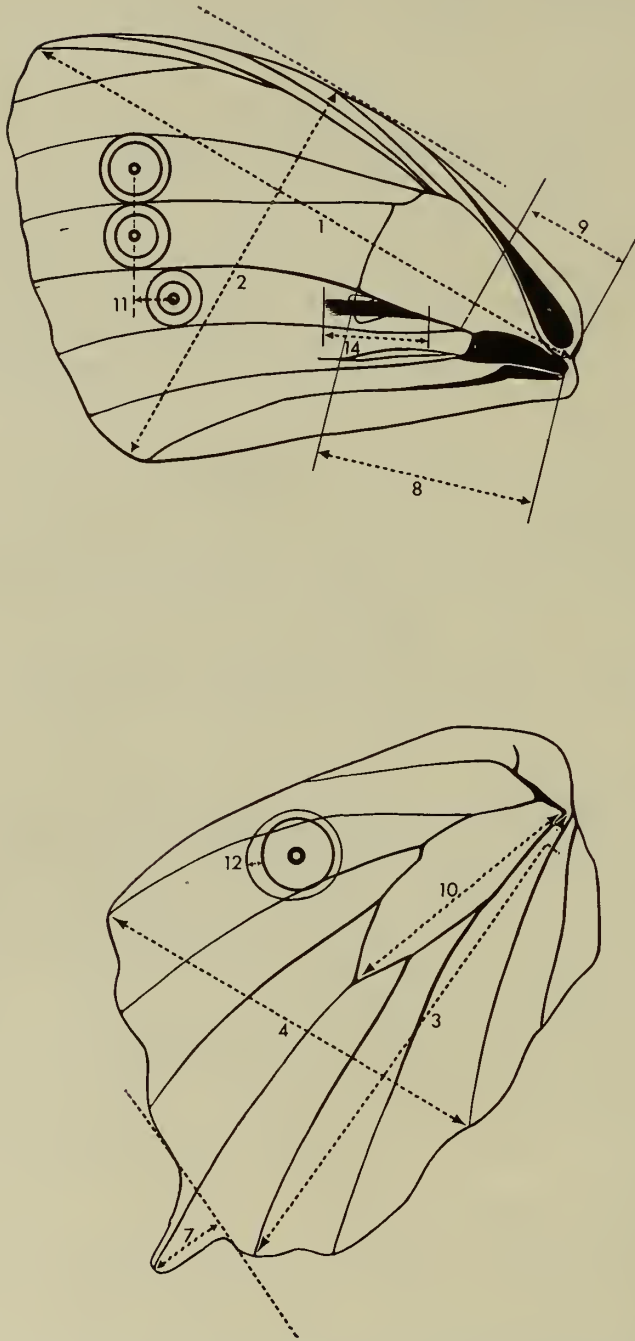


FIG. 16. Position of measurements taken for biometric study (see Table 1 for additional description) superimposed on venation of *Ptychandra lorquini* *lorquini*.

structure and ornamentation of the wing. A multivariate study of the variation and covariation between characters is effective for elucidating subtle changes in shape and ornamentation. A small change in the ratio of two highly correlated characters between taxa provides a simple means of identifying the taxa; a multivariate approach (Blackith & Reyment, 1971) utilizing canonical variates potentially provides an even more effective means of separating and identifying taxa. Suites of correlated characters exhibiting subtle changes in their relative proportions between taxa can be combined to provide a final mathematical expression for identification.

In order to study the divergence between the taxa, and particularly the problems discussed above, a series of biometric characters were measured as detailed in Table 1 and shown, where appropriate, in Text-fig. 16. Characters 1-4 were taken with a travelling microscope and characters 7-14 were measured with a microscope fitted with a calibrated eyepiece. All characters except 13 and 14 refer to wing shape, structure and ornamentation.

The taxa considered in this study are given in Table 2, detailing numbers of individuals within the taxa for which a complete data series was available. The fragility of the specimens, most of which were collected more than 60 years ago, resulting in absence of tails or antennae, restricted complete data on some specimens, while scarcity (rarity) of collected individuals for other taxa restricted their numbers. The extensive series of *leucogyne* and *lorquini leytensis* were obtained after completion of the biometric observations.

The multivariate approach adopted to study the divergence between the taxa

TABLE 2

Symbols used and number of individuals measured for taxa studied biometrically.

	Symbols for text-figs 17-22		No. of complete specimens measured	
	♂	♀	♂	♀
<i>P. leucogyne</i>	▽	▼	4	4
<i>P. lorquini bazilona</i>		⊙	5	3
<i>P. lorquini leytensis</i>	\	⊙	1	2
<i>P. lorquini lorquini</i> <sup>a</sup>	x	⊕	10	6
<i>P. lorquini plateni</i> <sup>a</sup>	—	⊕	17	10
<i>P. lorquini ex Palawan</i>	/	n.a.	3	0
<i>P. mindarana</i>	□	■	4	4
<i>P. negrasensis</i>	◇	◆	1	1
<i>P. schadenbergi</i> <sup>a</sup>		⊕	17 <sup>b</sup>	6
<i>P. talbati</i>	△	▲	4	1

a. taxa used for estimation of covariance matrices

b. males without external hair pencil

n.a. not applicable

TABLE 3  
 Canonical variate scores for *Ptychandra*, both sexes, all taxa, using the 8 significant characters.

Character <sup>(a)</sup> No.	CV I	CV II	CV III	CV IV
Character				
Forewing length	·008 <sup>(b)</sup> (-0·85) <sup>(c)</sup>	-·076 (.845)	-·042 (.468)	-·078 (-·808)
Forewing breadth	·048 (.412)	-·043 (-·364)	·059 (.504)	·041 (.348)
Hindwing length	·001 (.013)	·032 (.339)	-·018 (-·106)	·049 (.522)
Forewing cell length	-·054 (-·447)	-·142 (-1·172)	·053 (.440)	·129 (1·001)
Cell length to $CuA_1$	·348 (1·498)	·022 (.093)	-·039 (-1·066)	-·027 (-·118)
Hindwing cell length	-·103 (-·684)	·098 (.654)	·014 (.095)	-·072 (-·479)
Ocellus displacement	-·004 (-·012)	-·203 (-·640)	·110 (.343)	-·217 (-·677)
Yellow ring width	-·042 (-·047)	-·008 (-·648)	-·574 (-·648)	-·492 (-·555)
Canonical root	39·3	13·5	2·2	1·2
Canonical root derived from all characters	41·4	15·4	2·5	1·4

(a) See Table 1

(b) Canonical variate score (for  $m \times 10^{-4}$ )

(c) Canonical variate score normalized to unit variance.



primarily utilizes canonical variates (cf. Blackith & Reyment, 1971). For many of the taxa there are too few specimens to define adequately the character means and covariance (or correlation) structure. Therefore it is not possible to examine formally if, as is assumed in a canonical variates approach, the character variances and correlations between characters are similar from taxon to taxon. Hence the approach adopted in this study is to examine the canonical variates for their taxonomic significance, as well as their apparent statistical significance. Canonical variates that do not provide useful taxonomic separation are not considered.

A multivariate approach will only be of taxonomic value if the robustness of the results can be established. To this end, the covariance structure was determined from all the taxa, and from taxa with the largest numbers of specimens, namely *lorquinii plateni*, *l. lorquinii* and *schadenbergi* (males and females). Canonical analyses were determined with all taxa included, but with the covariance structure estimated by the two approaches detailed above. Alternatively, only the three taxa above were analysed; the remaining taxa were located by their canonical variate scores. Similarities in the relative affinities of the taxa, and the degree of separation between taxa, are taken to imply robustness of the results obtained. The results quoted here were produced by considering all taxa with the covariance structure estimated from the three longer series, since the three approaches gave comparable results with similar major groupings.

Characters which do not contribute significantly to the discrimination between

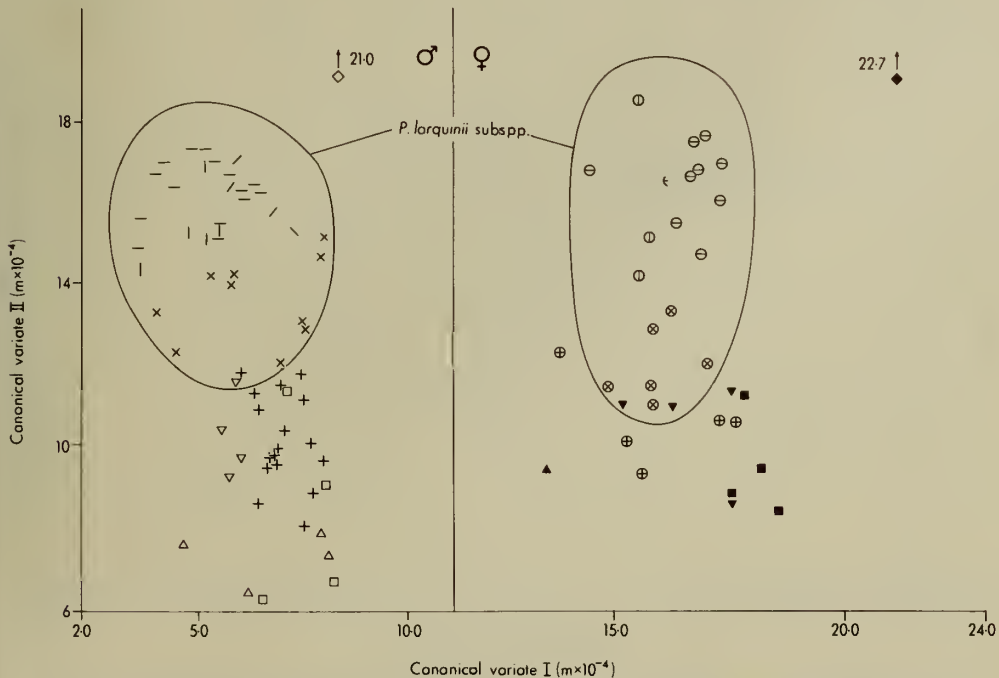


FIG. 17. Biometric study. First and second canonical variate scores for all taxa.

the taxa can be eliminated; these will generally be characters with small standardized canonical variate coefficients (i.e. the canonical variate coefficients multiplied by their respective pooled standard deviations). The effect of eliminating characters can be studied by observing the effect on the canonical root; little change means little loss of discrimination.

An analysis of all taxa showed that only eight of the eleven characters contributed to the discrimination; further elimination of characters reduced discrimination between the taxa. The canonical variates and canonical roots (from the analysis with the covariance matrix estimated from the three taxa) for eight characters are given in Table 3. The canonical roots for the analysis with all characters included are also given for comparison.

Individual scores for each taxon for the first two canonical variates are shown in Text-fig. 17. The first canonical variate reflects pronounced sexual dimorphism within the genus; this largely results from a contrast of character 9, the length of vein  $CuA_1$ , relative to character 8. The length of  $CuA_1$  is strongly affected by the position of the brand in the male.

The second canonical variate shows almost complete separation of the *lorquini* subspecies from the rest of the genus. This separation results from a contrast between character 8, a measure of the forewing cell length, relative to the length

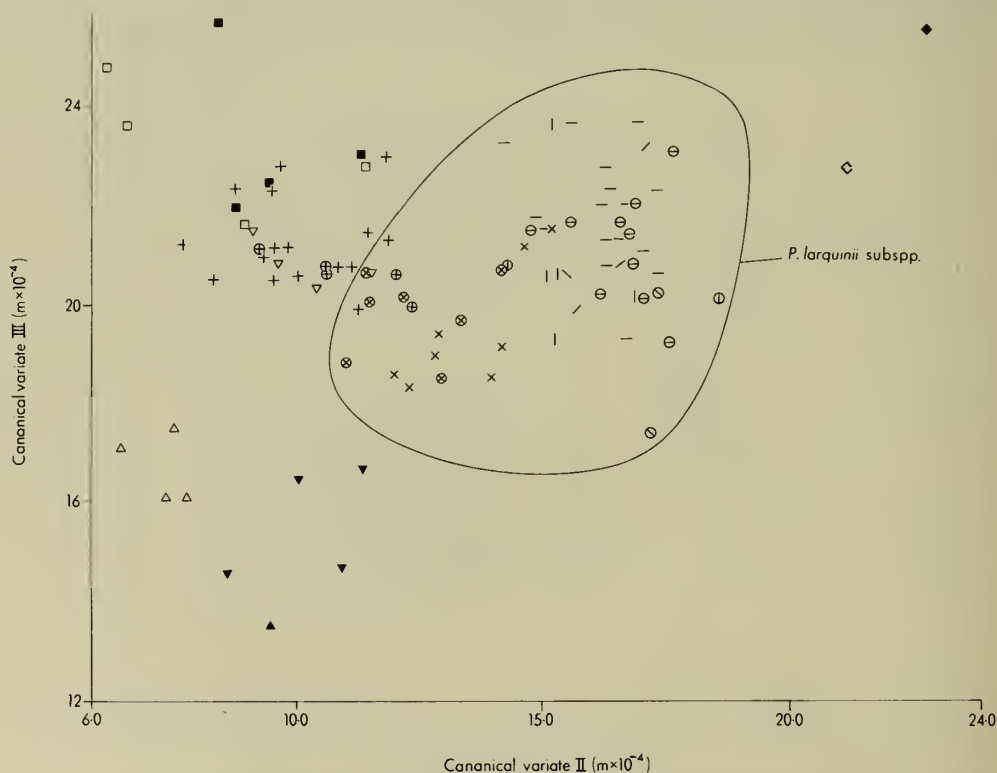


FIG. 18. Biometric study. Second and third canonical variate scores for all taxa.

of the hindwing cell and forewing. Ocellus displacement, character 11, is also important. *P. leucogyne* and *lorquinii lorquinii* males are separated on this variate. The third canonical variate (Text-fig. 18) discriminates between *talboti* and the other taxa.

The fourth canonical variate, when considered with the second (Text-fig. 19) achieves a remarkable clustering of the males and females of the individual taxa in this strongly dimorphic genus, confirming the correct pairing of the sexes. (The females of *leucogyne* were incorrectly taken to be the females of *schadenbergi* by Semper (1886). These two species are insufficiently distinguished to give proof of this error.)

In the above analysis, the subspecific differences between the putative Palawan representatives of *lorquinii* and those from the other islands are masked because of the larger differences between *lorquinii* and the other species. A canonical analysis of the males of *lorquinii* from Luzon, Palawan, Mindanao and Basilan (with the

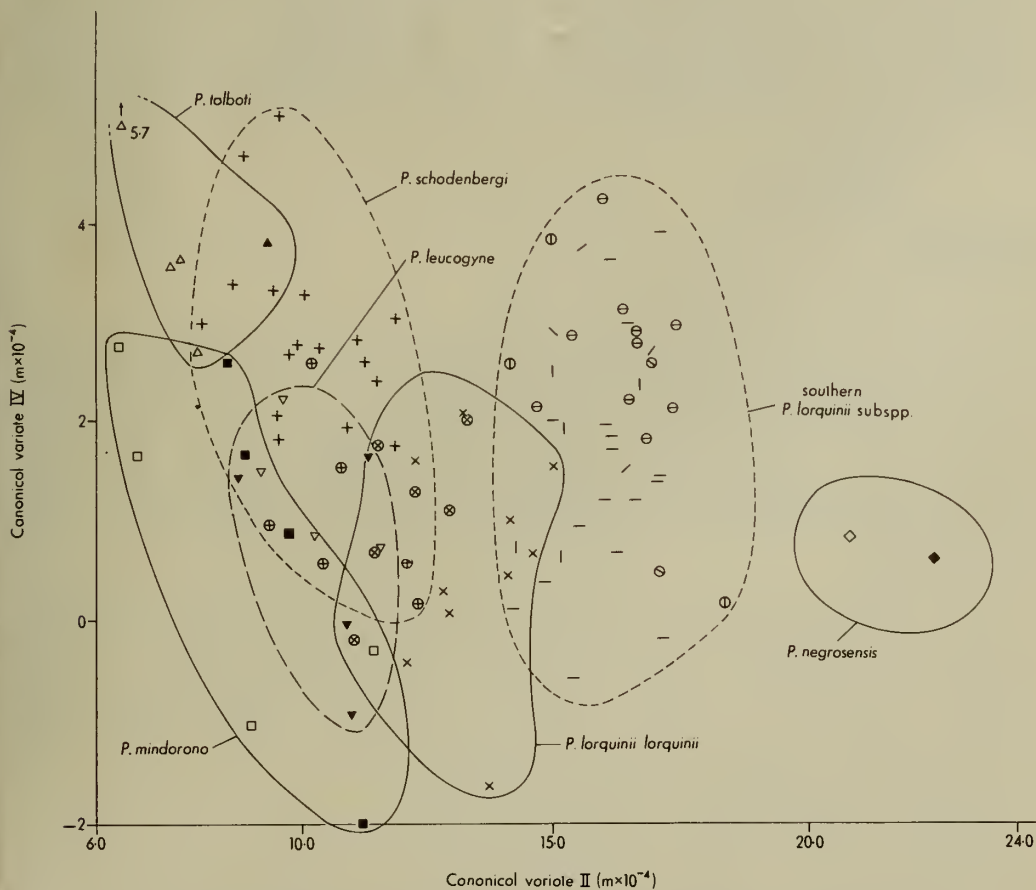


FIG. 19. Biometric study. Second and fourth canonical variate scores for all taxa.

covariance structure estimated, as before, from the larger samples) was carried out. The results were again robust with respect to the approaches detailed above. The canonical variates and canonical roots are given in Table 4, while the canonical variate scores for all specimens for the first and second canonical variates are given in Text-fig. 22. The first canonical variate separates the Luzon representative (*l. lorquinii*) from the southern races, and to a lesser degree *l. basilana* from *l. plateni*.

TABLE 4

Canonical variate scores for *P. lorquinii* subspecies (males only) using 9 characters.

Character <sup>(a)</sup>		CV I		CV II	
No.	Character				
1	Forewing length	·050 <sup>(b)</sup>	(·770) <sup>(c)</sup>	-·069	(-1·063)
2	Forewing breadth	-·007	(-·083)	·083	(·986)
3	Hindwing length	·012	(·177)	·070	(1·041)
4	Hindwing breadth	-·010	(-·148)	-·077	(-1·082)
8	Forewing cell length	·016	(·187)	·022	(·247)
9	Cell length to <i>CuA</i> <sub>1</sub>	-·113	(-·677)	·127	(·762)
10	Hindwing cell length	·058	(·538)	-·047	(-·437)
11	Ocellus displacement	-·113	(-·494)	-·140	(-·610)
12	Yellow ring width	-·194	(-·305)	-·210	(-·330)
	Canonical root		1·71		0·23 <sup>NS</sup>
	Canonical root from all characters		1·79		0·25

(a) See Table 1

(b) Canonical variate score (for  $m \times 10^{-4}$ )

(c) Canonical variate score normalised for unit variance

The second canonical variate (with the first) tends to separate the Palawan specimens from those of Basilan and Mindanao. Analyses of the three taxa, with the covariance structure estimated by the approaches given above and from *lorquinii* subspecies only, all show some overlap of *lorquinii basilana* and *l. plateni*, and separation of the individuals from Palawan and the other localities. While this separation may sometimes be inadequate for confident identification, it does indicate the likely taxonomic distinctness of the Palawan race from *lorquinii plateni* and *l. basilana*.

It is of interest to note that only the first canonical root is statistically significant. Clearly, there is marked overlap of the taxa along the second canonical variate; the means for *l. lorquinii*, *l. basilana* and *l. plateni* are virtually coincident along this variate. And yet it is the second canonical variate which tends to separate the Palawan specimens from *l. plateni* and to a lesser degree *l. basilana*. Hence both the taxonomic (or biological) and statistical significance of canonical variates should be examined in morphometric taxonomic studies.

No information is available on ecological differences between *lorquinii* and *schadenbergi* flying together in Mindanao but, given the sort of evolutionary history of the genus outlined above, *l. plateni* would appear to have undergone character displacement in Mindanao. Character displacement has been defined by Grant (1972)



as 'the process by which a morphological character state of species changes under natural selection arising from the presence, in the same environment, of one or more species similar to it ecologically and/or reproductively'. In the case of *Ptychandra* there is not the 'control' situation discussed by Brown & Wilson (1956) where both species, overlapping and interacting, exist also allopatrically so that comparisons can be made between the sympatric and allopatric states in each species. Only *lorquinii* occurs allopatrically in Luzon and the central Philippines (though interacting possibly with *leucogyne*). The suggestion that character displacement has occurred is based on the observation that in several characters where allopatric *lorquinii lorquinii* resembles *schadenbergi*, *lorquinii plateni* differs markedly from both. This is illustrated in several biometric parameters. *P. lorquinii plateni* is significantly larger than both other forms ( $P < 0.001$ ) indicated by characters 1-4, 10 and 13 (see Table 1). It differs significantly ( $P < 0.001$ ) in the displacement of the posterior forewing subapical ocellus character 11, plotted against character 1 in the scatter diagrams in Text-figs 20, 21. Whereas the white markings of the female forewing of *l. lorquinii* and *schadenbergi* are generally similar, those of *l. plateni* are modified into a band from the centre of the costa to the tornus as in female *negrosensis*. Biometrically (see Text-figs 16-19) *lorquinii leytensis* is placed with *lorquinii plateni* and *lorquinii basilana* but in ♂ and ♀ facies it is

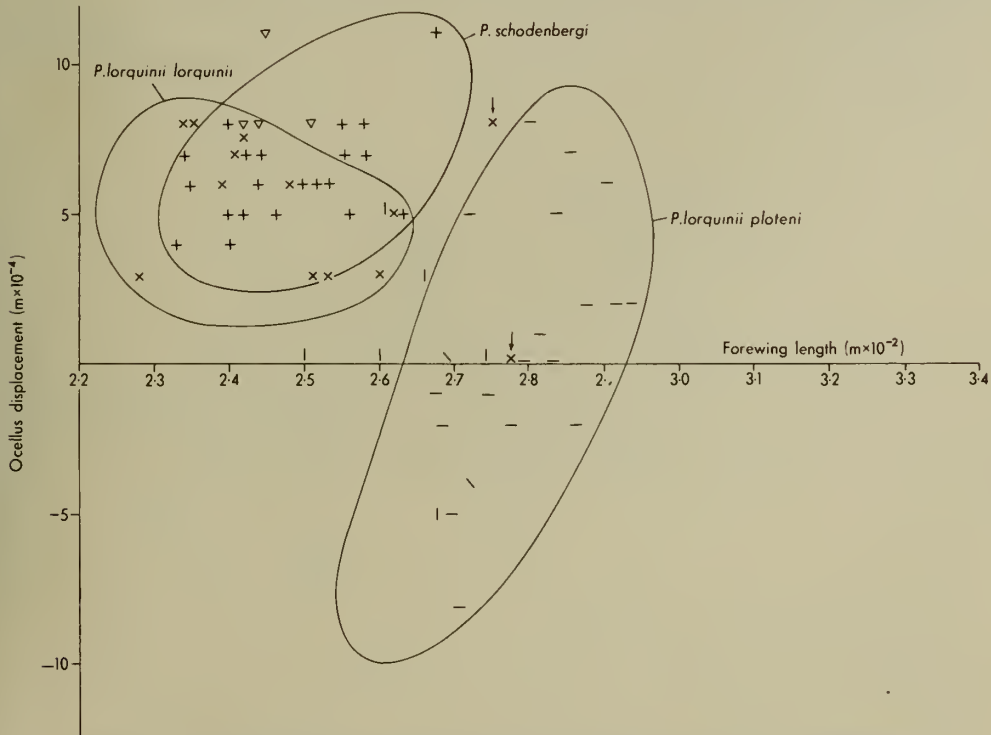


FIG. 20. Ocellus displacement against forewing length for male *Ptychandra schadenbergi*, *P. lorquinii lorquinii* and *P. lorquinii plateni*.

intermediate between these and *lorquini* *lorquini*. A clinal pattern cannot be ruled out.

Positive identification of character displacement in *plateni* must await resolution of the second criterion identified by Grant (1972), that the observed differences between the sympatric and allopatric forms of *lorquini* should be directly attributable to selection arising from the presence of *schadenbergi*. This awaits further study of the ecology of the species involved and of their variation.

#### HAIR PENCIL AND BRAND STRUCTURES IN *PTYCHANDRA*

The secondary sexual characters of male *Ptychandra* – brands, hair pencils and pouches – provide good diagnostic features at the species level and are of interest as one of the main differences between the genus and other Lethini. Consequently they have been studied in detail and their structures are given comparatively here rather than under each species.

The most prominent features are found on the forewing just below the cell close to the origin of  $M_3$  and are illustrated in Pls 1 and 2. Only *schadenbergi* does not possess a broad black hair pencil (Pl. 2, fig. 4). For the remaining five species the pencil arises close to the origin of  $M_3$  and usually covers a patch of broad modified scales. Three forms of this structure are recognizable.



FIG. 21. Ocellus displacement against forewing length for female *Ptychandra schadenbergi*, *P. lorquini lorquini* and *P. lorquini plateni*.

Type (a) (Pl. 1, fig. 1). The hair pencil arises from a poorly defined area at the base of cell  $M_3$  which is characterized by brown, not purple, scales. The pencil overlays part of cell  $CuA_1$  containing a roughly triangular area of slate-grey scales (*talboti*).

Type (b) (Pl. 1, fig. 2; Pl. 2, fig. 4). The hair pencil arises from a sharply defined pale elliptical area at the base of cell  $M_3$  and extends over  $CuA_1$ . The vein is sunken there and the depression is filled with shiny black scales (*leucogyne*, *mindorana*).

Type (c) (Pl. 1, fig. 3; Pl. 2, fig. 6; Text-fig. 1). The hair pencil arises from the lower vein of the cell at the base of cell  $M_3$  and extends into cell  $M_3$  covering a well defined roughly circular area of pale mealy scales (*lorquinii* subspp. (except *leytensis* which lacks the mealy scales), *negrosensis*).

In addition to these structures all species except *talboti* have a pouch in the inter-neural furrow of cell  $CuA_1$  which runs from the base of the cell for about a third to half of its length. This contains a delicate light brown hair pencil of the same length as the pouch. The pencil arises external to the pouch at the origin of  $CuA_2$  and can be seen entering the pouch. It can be brought out by hooking a fine needle into the loop of hair between the pencil origin and where it enters the pouch. The structure is surrounded by an area of very small turquoise scales that are restricted to cell  $CuA_1$  with forewing brand type (c) and surround the shiny black scales in brand type (b).

The hindwing brand structures (Pl. 3, figs 7-12) occur in the cell at the base of

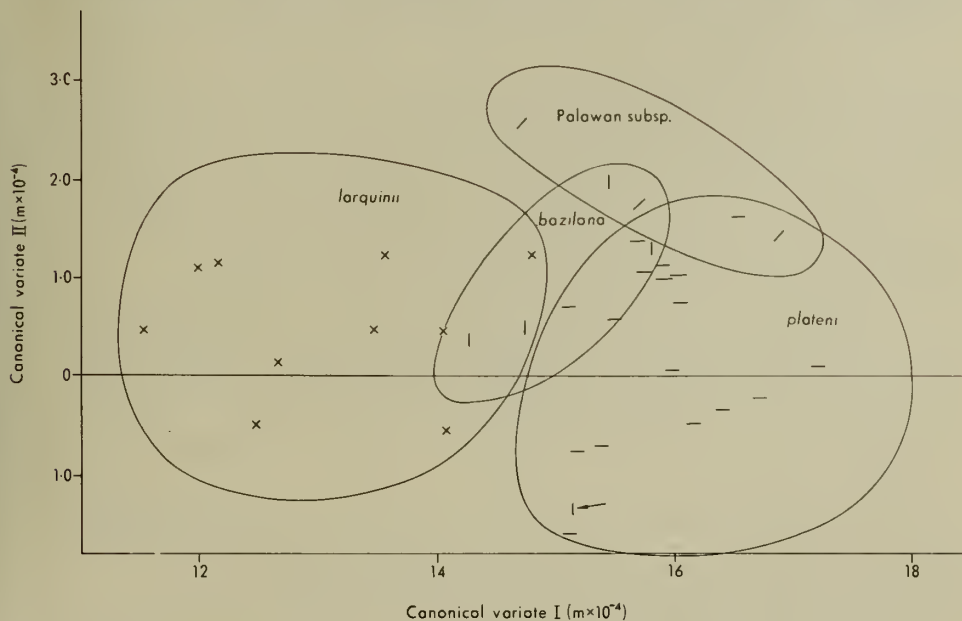


FIG. 22. Biometric study. First and second canonical variate scores for *Ptychandra lorquinii* subspecies (males).

*Rs.* In *lorquini* no modification of the basic regular rows of purple scales is apparent. In *mindorana* there is an elongate area of larger, more irregular scales, while *schadenbergi* often has a concentration of hairlike androconia over a patch where the purple scales are lacking. In the other three species a prominent black hair pencil extends over a depression filled with black shiny scales at the origin of  $M_1$ . The general form is similar to that of forewing brand type (b).

KEY TO THE SPECIES OF *PTYCHANDRA*

- |    |   |    |
|----|---|----|
| 1  | Upperside predominantly deep blue. Males . . . . .  | 2  |
| -  | Upperside brown and white. Females . . . . .  | 7  |
| 2  | Black external hair pencil on forewing . . . . .  | 3  |
| -  | No such external hair pencil.   |    |
|    | Hair pouch between veins $CuA_1$ and $CuA_2$ present. Gnathos terminally hooked<br>without dorsal teeth . . . . . <i>schadenbergi</i> (p. 244)  |    |
| 3  | Black hair pencil on upperside forewing arising at base of vein $M_3$ . . . . .   | 4  |
| -  | Hair pencil arising in cell $M_3$ . . . . .   | 5  |
| 4  | Black hair pencil at anterior margin of hindwing cell. Two or less forewing sub-<br>marginal ocelli. . . . . <i>negrosensis</i> (p. 250)  |    |
| -  | No such hair pencil on hindwing. Three submarginal ocelli on underside forewing.<br><i>lorquini</i> (p. 237)  |    |
| 5  | Forewing hair pencil arising from a well defined pale elliptical area and covering<br>black specialized scales straddling $CuA_1$ . Forewing greater than 24 mm . . . . .   | 6  |
| -  | Forewing hair pencil arising from a loosely defined dark area and covering a triangular<br>patch of slate-grey mealy scales in cell $CuA_1$ . Forewing less than 21 mm.<br>Four forewing submarginal ocelli. Gnathos smooth, without terminal hook<br><i>talboti</i> (p. 248) |    |
| 6  | Black hair pencil in hindwing cell arising at base of vein <i>Rs.</i> Four forewing sub-<br>marginal disjunct ocelli. Hindwing tail hooked. Gnathos smooth, tapered<br>distally. Tip of uncus smoothly curved . . . . . <i>leucogyne</i> (p. 246)                             |    |
| -  | No such hair pencil. Three conjoined forewing submarginal ocelli. Tails of hind-<br>wing straight. Gnathos toothed dorsally. Tip of uncus indented ventrally<br><i>mindorana</i> (p. 245)   |    |
| 7  | Discal area of upperside hindwing predominantly white or off-white . . . . .  | 8  |
| -  | Discal area of upperside hindwing predominantly brown . . . . .   | 10 |
| 8  | Three conjoined submarginal ocelli on forewing underside. Tails at vein $M_3$ straight<br><i>schadenbergi</i> (p. 244)  |    |
| -  | Four disjunct submarginal ocelli on underside forewing. Tail at vein $M_3$ hooked . . . . .   | 9  |
| 9  | White area of forewing upperside not extending to inner margin. Forewing less than<br>22 mm . . . . . <i>talboti</i> (p. 248)   |    |
| -  | White area of forewing upperside reaching inner margin. Forewing greater than<br>24 mm.<br>Tail hooked . . . . . <i>leucogyne</i> (p. 246)  |    |
| 10 | Discal area of hindwing upperside with dull reddish area around costal ocellus.<br>Forewing 35 mm . . . . . <i>negrosensis</i> (p. 250)   |    |
| -  | Discal area brownish without reddening around costal ocellus . . . . .  | 11 |
| 11 | Hindwing tails straight, equal or subequal on veins $M_2$ , $M_3$ , and $CuA_1$ .<br>Hindwing outer margin smoothly curved . . . . . <i>mindorana</i> (p. 245)  |    |
| -  | Tail on $M_3$ hooked and much longer than those on other veins. Tails on $M_2$ and<br>$CuA_1$ much less than that on $M_3$ . . . . . <i>lorquini</i> (p. 237)   |    |



The brief key given by Fruhstorfer (1911) for the separation of *lorquinii* and *schadenbergi* appears to be incorrect and misleading. *P. schadenbergi* is said to possess a hindwing hair pencil in the cell and a short stiff hair pencil below  $M_3$  on the forewing. Both these features are found in *leucogyne*, only the latter in *lorquinii* and neither in *schadenbergi*. However, in the majority of specimens of *schadenbergi* there is a small narrow patch on the hindwing in the cell close to the origin of  $R_s$  where the hindwing hair pencil is found in other *Ptychandra* which lacks purple scales. Fruhstorfer states that *lorquinii* possesses a short hair pencil between '1st and 2nd median veins' ( $CuA_1$  and  $CuA_2$ ). This may either refer to the long hair tuft enclosed in the deep pouch in this position or to the prominent short hair pencil arising in *lorquinii* close to the lower discocellular vein and shading a black androconial patch in cell  $M_3$ . The extent of curvature of the lower discocellular vein used by Fruhstorfer (1911) to separate *schadenbergi* and *lorquinii* is unreliable.

## DESCRIPTIONS OF THE SPECIES

*Ptychandra lorquinii* Felder & Felder

(Text-figs 1, 2, 8; Pl. 1, fig. 3; Pl. 3, fig. 7; Pl. 4, figs 13, 14)

*Ptychandra lorquinii* Felder & Felder, 1861 : 304; Felder & Felder, 1867 : 498, pl. 68, figs 1, 2, 3; Semper, 1886 : 58 (in part); Staudinger, 1887 : 22, pl. 78, 2 figs.  
*Ptychandra lorquini* Fruhstorfer, 1899 : 80; 1908 : 222; 1911 : 330; Gaede, 1931 : 320; Lewis, 1973 : 276, pl. 172, fig. 1. [Unjustified emendation.]

DESCRIPTION. ♂. Forewing length 22.9–29.2 mm. *Facies*. Upperside deep iridescent blue, diffusely margined with dark brown, sometimes extending to ocellar area. Forewing with subapical rhomboidal white fleck on costa and inwardly pointing submarginal white chevrons in cells  $R_s$  to  $1A$  with maximum convexity half way or more than half way distally on costa. The white markings may be reduced or diffuse in some subspecies. Forewing brand type (a) (Pl. 1, fig. 1). Hindwing quadrate, tailed at  $M_3$ , with cell  $M_2$  excavated more deeply than cell  $M_3$ , giving tail a hooked appearance. Tail obtusely terminated. Not tailed at vein  $M_2$ . Hindwing brand in cell absent, hindwing ocelli sometimes darkly visible on upperside. Underside ground colour mid-brown with discal area traversed by three chocolate-brown wavy bands. Hindwing submarginal ocelli in cells  $R_s$  to  $1A$  disjunct, with that in cell  $R_s$  inwardly displaced and enlarged. Forewing with equal or subequal ocelli in cells  $M_1$ ,  $M_2$  and  $M_3$ , that in cell  $M_3$  displaced inwardly. Fringes white, interrupted with brown at vein ends. *Antennae*. Club tip rufous with base dark brown. Shaft with uniform grey-brown scales dorsally, rufous ventrally with pale flecks towards base. *Genitalia*. Valves with variable sclerotized processes at apex, long setae on outer surface. Aedeagus similar to that of *schadenbergi* (Text-fig. 3b). Gnathi with dorsal teeth and with tip hooked and broadened (e.g., Text-fig. 6).

♀. Forewing length 25.7–32.7 mm. *Facies*. Upperside forewing ground colour brown broken by a white subapical fleck, submarginal white chevrons, white spots in the position of the submarginal ocelli in cells  $M_2$  and  $M_3$  underside (which may be reduced or sometimes absent), and a broad white post discal band arising near centre of costa running diagonally to  $M_3$  sometimes broken or conjoined with white subdiscal band extending from close to submarginal ocelli to below the cell but not reaching inner margin. The extension of the line of the forewing postdiscal band passes below white spot in cell  $M_2$  if present. Underside forewing

with three confluent ocelli decreasing in size posteriorly and with those in cells  $M_2$  and  $M_3$  usually white. Wing shape similar to male but forewing costa evenly curved. Upperside hindwing discal area predominantly light brown but becoming off-white around ocelli in cells  $R_5$  to  $M_2$ . Ocelli in cells  $CuA_1$  and  $M_3$  ringed with buff; those in cells  $R_5$ ,  $M_1$ ,  $M_2$ ,  $1A + 2A$  darker, less distinct and confluent. Underside off-white ground colour marbled with brown with ocelli placed as male, edged inwardly and marginally with diffuse cream zone. Fringes off-white interrupted by light brown at vein ends. *Antennae*. As males but strongly flecked with pale scales basally.

**DISTRIBUTION.** Luzon, Marinduque, Leyte, Bohol, Samar, Panay, Mindanao Basilan, Palawan. Recorded from the Polillo Is. (Fontaine, 1926) and Babuyan Is. (Semper, 1887) but these specimens were not found in the collections searched. Notably absent from material from Mindoro and Negros.

**BIOLOGY.** See under subspecies of *lorquinii*.

**DISCUSSION.** Fruhstorfer (1899) and subsequent authors refer to *lorquinii* as '*lorquini*', an unjustified emendation.

*P. caerulans* is considered here to be a synonym of *lorquinii* and is attributable to the nominate subspecies. The blue colour of the upperside, which is somewhat variable in *lorquinii*, is paler than usual in the unique male holotype of *caerulans* but otherwise it is not distinguishable. Genitalia are as *lorquinii*. Fruhstorfer (1908) himself expressed doubts as to the validity of the species.

This species of *Ptychandra* exhibits a number of distinct island races, described below.

#### KEY TO THE SUBSPECIES OF *P. LORQUINII*

- |   |  |                                     |
|---|--|-------------------------------------|
| 1 | Upperside predominantly purple, males . . . . .  | 2                                   |
| – | Upperside brown and white or cream, females . . . . .  | 5                                   |
| 2 | White or brown mealy scales present beneath forewing hair pencil in cell $M_3$ . . . . .   | 3                                   |
| – | Mealy scales absent or scarce beneath forewing hair pencil.<br>Forewing length 26.9–27.2 mm . . . . .  | <i>lorquinii leytensis</i> (p. 242) |
| 3 | Hindwing underside ocelli white-pupilled, ringed outwardly with black, mid-brown, buff and mid-brown bands, the middle bands being separated by a thin dark brown line. Ocellus in forewing cell $M_3$ proximally displaced from the line joining those in cells $M_1$ and $M_2$ .<br>Forewing length 22.9–27.8 mm . . . . . | <i>lorquinii lorquinii</i> (p. 239) |
| – | Hindwing underside ocelli white-pupilled, ringed with black, light brown, buff and mid-brown without a dark dividing line between the middle bands. Ocellus in forewing cell $M_3$ either proximally or distally displaced . . . . .   | 4                                   |
| 4 | Forewing length 26.7–29.3 mm . . . . .   | <i>lorquinii plateni</i> (p. 241)   |
| – | Forewing length 25.0–27.4 mm.<br>Dorsal surface of gnathos with few but large teeth (Text-fig. 7)  | <i>lorquinii basilana</i> (p. 242)  |
| 5 | Ground colour chocolate-brown. Subapical forewing white band constricted or broken in cell $M_3$ . . . . .   | <i>lorquinii leytensis</i> (p. 242) |
| – | Ground colour sandy or reddish brown. Subapical forewing white band entire or broken in cell $M_3$ . . . . .   | 6                                   |
| 6 | Hindwing underside ocellus white pupilled and ringed outwardly with dark brown, buff, and mid-brown bands; the two buff bands being separated by a thin dark   |                                     |

brown line. Forewing cell  $M_3$  ocellus proximally displaced relative to those in cells  $M_1$  and  $M_2$ .

Upperside subapical white band not continuous with discal white patch

- lorquinii lorquinii* (p. 239)
- Hindwing underside ocellus white pupilled and ringed with dark brown, light brown, buff and mid-brown bands, without a dark dividing line between the two middle bands. Forewing cell  $M_3$  ocellus distally displaced relative to those in cells  $M_1$  and  $M_2$  . . . . . 7
- 7 Broad unbroken postdiscal off-white band running from halfway along costa to discal white area, sometimes slightly constricted in cell  $M_3$  *lorquinii plateni* (p. 241)
- Subapical off-white postdiscal band strongly constricted or broken in cell  $M_3$  *lorquinii basilana* (p. 242)

The key above has been based where possible on qualitative rather than biometric characters. However, in the case of male *lorquinii plateni* and *l. basilana* differentiation is difficult and may be assisted by measurement of several parameters (see biometric section). The range of measurements given is that actually observed and is limited by the sample size (see individual descriptions).

### *Ptychandra lorquinii lorquinii* Felder & Felder

(Text-figs 1, 2, 8; Pl. 1, fig. 3; Pl. 3, fig. 7; Pl. 4, figs 13, 14)

*Ptychandra lorquinii lorquinii* Felder & Felder, 1861 : 304. LECTOTYPE ♂, PHILIPPINES: Luzon (BMNH), here designated [examined].

*Ptychandra caerulans* Fruhstorfer, 1908 : 223; 1911 : 330; Gaede, 1931 : 320. LECTOTYPE ♂, PHILIPPINES: Luzon (BMNH), here designated [examined]. **Syn. n.**

*Ptychandra lorquinii* f. *obscurior* Fruhstorfer, 1908 : 223; Gaede, 1931 : 320. Type-material (not definitely located), PHILIPPINES: Luzon. **Syn. n.**

*Ptychandra lorquinii obscurior* Fruhstorfer; Fruhstorfer, 1911 : 330.

DESCRIPTION. ♂. Forewing length 22.9–27.8 mm,  $n = 15$ . *Facies*. Upperside deep iridescent blue with forewing prominently marked with a white apical fleck and submarginal chevrons. Underside usually traversed with metallic wavy bands. Hindwing ocelli with white pupils ringed outwardly with black, mid-brown, buff and mid-brown bands, the middle bands being separated by a thin dark brown line. *Genitalia* (Text-fig. 6). Gnathos with broadened, hooked distal ends and two or more prominent dorsal teeth.

♀. Forewing length 25.7–28.4 mm,  $n = 8$ . *Facies*. Upperside ground colour mid-brown with a subapical white band extending from vein  $M_3$  to approximately halfway along costa, usually disjunct from subdiscal white band but occasionally just meeting it. Subdiscal white band usually running almost completely along the length of inner margin but separated from it by a thin brown area. White spot corresponding to cell  $M_2$  underside ocellus present and often a similar spot corresponding to cell  $M_3$ . Width of yellow ring of hindwing underside costal ocellus 0.4–1.0 mm,  $\bar{x} = 0.76$  mm,  $n = 16$ . Ocelli white-pupilled, ringed successively with dark brown, buff, buff and mid-brown bands; the two buff bands being separated by a thin dark brown line.

DISTRIBUTION. Luzon. Five males attributable to this subspecies in Carnegie Museum were labelled 'Mindanao'. As specimens from other genera from the same



collection were labelled Mindanao, yet of the Luzon subspecies (H. Clench, personal communication), it seems reasonable to assume that these *Ptychandra* specimens were mislabelled.

**BIOLOGY.** Said to fly from April to January (Semper, 1886) but material has been seen from almost all months.

**DISCUSSION.** The holotype of *P. caerulans* is attributable to this subspecies.

*P. lorquinii obscurior* is synonymized here. It was described (Fruhstorfer, 1908) as having the white areas of the hindwing reduced, a normal feature of the typical subspecies. First described as a forma, it was later elevated to subspecific rank (Fruhstorfer, 1911) without comment. An apparently normal female from Fruhstorfer's collection bears his 'type' label (see Material examined below) and corresponds with his brief description. He refers for differentiation to the illustration given by Staudinger (1892), but this is not substantially different in marking from the lectotype. The type of this form or subspecies did not appear in the catalogue of the Fruhstorfer collection (Martin, 1922 : 66). In the description of the female forma *obscurior* (Fruhstorfer, 1908) the specimens, presumably males, are described with androconial patches as for the typical form and are not distinguished.

In addition to variation in colour of the purple upperside *lorquinii* varies considerably in the brightness of the underside markings and the distinctness of the subapical fleck and antemarginal chevrons. The underside of some specimens is marked with metallic wavy lines, as commonly found in *mindorana*. One specimen has been found with two forewing ocelli and one with four, the extra spot being in cell  $CuA_1$ , not cell  $R_5$  as in *leucogyne* (q.v.).

#### MATERIAL EXAMINED.

*Ptychandra lorquinii*, lectotype ♂, LUZON, genitalia preparation no. TGH 1966-689 (BMNH); 1 ♀ paralectotype, LUZON (*Lorquin*) (BMNH); 3 ♂ putative paralectotypes, LUZON (BMNH). *Ptychandra caerulans*, lectotype ♂, LUZON, genitalia preparation no. TGH 1966-690 (BMNH). *Ptychandra lorquinii* f. *obscurior*, syntype ♀, LUZON (BMNH).

LUZON: 16 km W. of Baguio, 2500 ft, 1 ♂, 14.xi.1966 (*C. G. Treadaway*) (BMNH); Baguio, 2 ♂, 2 ♀, (CM); Baguio City, 3 ♀, ix. 1957 (*C. G. Treadaway*) (BMNH); Bataan, 1 ♂, 11-20.vi.1880 (BMNH); Cape Engano, 1 ♂ (*Whitehead*) (BMNH); Klondyke, 800 ft, 19 ♂, 6 ♀, 19-27.xii.1911, 1-26.iv.1912, 23.v.1912 (*A. E. Wileman*) (BMNH); Lepanto, 1 ♂ (*Whitehead*) (BMNH); Los Baños, 1 ♂, 10.ix.1920 (BMNH); Los Baños, 1 ♂, 10.ix.1920 (AMNH); Los Baños, 1 ♂, 14.v.1911 (*A. E. Wileman*) (BMNH); Los Baños, 1 ♂, 3 ♀, (BMNH); Marivelis, 1 ♂, 11.xi.81 (SMN); Montalban, Rizal, 1 ♂, 2 ♀, 4. i, 5.ii.1914 (*A. E. Wileman*) (BMNH); Montalban, 1 ♂, 29.viii.1966 (*C. G. Treadaway*) (BMNH); Montalban 100 m, 1 ♂, 26.vi.1971 (*C. G. Treadaway*) (BMNH); Mt Arajat, 1 ♂, 1 ♀, viii. 1903 (*Browne*) (BMNH); Mt Makiling, 1 ♂, 4.viii.1956 (*C. G. Treadaway*) (BMNH); Mt Makiling, 1500 ft, 1 ♂, 3 ♀, viii, 4.ix.1966 (*C. G. Treadaway*) (BMNH); Palali, Benguet, 2000 ft, 6 ♂, 5 ♀, 21-25.xiii.1912, 27.vi.1913 (*A. E. Wileman*) (BMNH); Pulang Lupa, Rosales, 1 ♂, 12.xi.81 (SMN); Quezon Nat. Park, 1100 ft, 3 ♂, 2 ♀, 27-29.iv.1969 (*C. G. Treadaway*) (BMNH);

Quezon Nat. Park, Atimonan Road, 1 ♂, 18.v.1968 (*C. G. Treadaway*) (BMNH); Sierra Madre, 1 ♂ (*C. G. Treadaway*) (BMNH); Tarlac, 4 ♂ (*Browne*) (BMNH); Tagaytay Ridge, 1800 ft, 9 ♂, 8 ♀, 3.ix.1966 (*C. G. Treadaway*) (BMNH); 'N. Luzon' 5000-6000 ft, 1 ♂ (*Whitehead*) (BMNH); Luzon, 1 ♂, 2 ♀ (BMNH). MARINDUQUE: 3 ♂, 1 ♀, vi. 1972, x. 1973 (*C. G. Treadaway*) (BMNH). MINDANAO: Mindanao, 5 ♂ (*Haslam*) (CM).

*Ptychandra lorquinii plateni* Semper **stat. n.**

(Text-fig. 6; Pl. 4, fig. 15)

*Ptychandra lorquinii* Felder & Felder; Semper, 1886-95 [in part].

*Ptychandra plateni* Semper, 1892 : 328. LECTOTYPE ♂, PHILIPPINES: North Mindanao (SMN), here designated [examined].

*Ptychandra lorquinii mindanaensis* Fruhstorfer, 1899 : 80; 1908 : 223; 1911 : 330. LECTOTYPE ♀, PHILIPPINES: Mindanao (BMNH), here designated [examined]. **Syn. n.**

*Ptychandra lorquinii* var. *mindanaensis* Fruhstorfer; Gaede, 1931 : 320.

**DESCRIPTION.** ♂. Forewing length 25.7-29.2 mm,  $n = 22$ . *Facies.* Upperside dull iridescent blue narrowly margined with dark brown. White apical fleck and marginal white chevrons faint or absent. Turquoise scales scattered between discal cell and costa. Underside marbled with dull brown and light brown without metallic wavy bands. Marginal ocelli with bluish white pupil ringed with black, light brown, buff and mid-brown, without a dark thin dividing line between the middle rings. Forewing submarginal ocellus in cell  $M_3$  either proximally or distally displaced (0.9-1.0 mm,  $\bar{x} = 0.02$  mm,  $n = 25$ ). *Genitalia.* Similar to those of *lorquinii lorquinii* (Text-fig. 2) but gnathos tending to be narrower at posterior end, less strongly reflexed and having more but smaller dorsal teeth which extend further anteriorly (Text-fig. 6). Valves similar to those of *lorquinii lorquinii* (Text-fig. 2) but lacking central terminal process.

♀. Forewing length 28.5-32.7 mm,  $n = 11$ . *Facies.* Broad unbroken median white band on forewing upperside running from about halfway along costa to tornus and with the subdiscal area uniformly brown. Median band sometimes slightly constricted in cell  $M_2$ . Submarginal white spot in cell  $M_2$  present, in cell  $M_3$  absent on upperside forewing. Ground colour sandy brown. Forewing submarginal ocellus in cell  $M_3$  displaced distally (0.1-1.3 mm,  $\bar{x} = 0.74$  mm,  $n = 18$ ). Maximum width of mid-brown band on costal ocellus, 0.5-1.0 mm,  $\bar{x} = 0.68$ ,  $n = 18$ . Ocelli with white pupil ringed with dark brown, light brown buff and mid-brown bands. *Genitalia.* Bursa copulatrix with signa consisting of two parallel bands of spines dorsally, each consisting of about 100 rows, length 2.5 mm, of straight short teeth placed 3 abreast. Width of each rank of 3 about 0.2 mm.

**DISTRIBUTION.** Mindanao. One specimen found labelled 'Manille'.

**BIOLOGY.** Said to fly from May to October and again in December and January (Semper, 1892).

**DISCUSSION.** Fruhstorfer (1899) considered *plateni* Semper to be a nomen nudum but Semper (1892) in his brief description refers back to his description of *P. lorquinii* in which the races of Luzon and Mindanao are adequately distinguished. The name *plateni* is therefore valid.

One male example of this subspecies was found which, though normal in pattern and structure, was abnormally large, having a forewing length of 31.0 mm.



## MATERIAL EXAMINED.

*Ptychandra lorquinii plateni*, lectotype ♂, MINDANAO: North, coll. C. Semper 'Typus SMFL 20' (SMN); paralectotypes, 1 ♂, 1 ♀, N. Mindanao (SMN); 1 ♂, 12.i.1882, SIBULAN (SMN); 1 ♂, BULLONIS, S., (SMN); 3 ♂, MINDANAO (BMNH); putative paralectotypes, 5 ♂, 3 ♀, MINDANAO (*Platen*) (MNHU); 1 ♂, DAVAO (*Platen*) (MNHU). *Ptychandra lorquinii mindanaensis*, lectotype ♀, MINDANAO (BMNH); paralectotype ♂, MINDANAO (BMNH).

MINDANAO: Agusan, Davao, 1 ♂, v. 1959 (*J. N. Jumalon*) (BMNH); Calian, Davao, 1 ♂, 31.v.1930 (*C. F. Clegg*) (CM); Davao, 2 ♂, 1 ♀ (*Platen*) (BMNH); Davao, 2 ♂, 1 ♀, iii. 1890 (BMNH); Jaliobong, Agusan, 1 ♂, 15.v.1968 (*C. G. Treadaway*) (BMNH); Kolambungan, Lanac, sea level, 1 ♂, 20.v.1914 (*A. E. Wileman*) (BMNH); Margosatubi, 1 ♂, (BMNH); Samboangan, 1 ♀, ix. 1891 (BMNH); Talaud, Davao, 1 ♀ (*O. Jumalon*) (BMNH); Talaud, Davao, 1 ♂, 8.ii.1961 (*C. G. Treadaway*) (BMNH); Mindanao, 1 ♀ (*J. J. Mounsey*) (BMNH); Mindanao, 16 ♂, 5 ♀, 1903-1904 (*J. Waterstradt*) (BMNH); N. Mindanao, 1 ♂ (BMNH); 1 ♂ (*Brabant*) (BMNH); Mindanao, 2 ♂, 3 ♀ (BMNH). LUZON: 'Manille', 1 ♀, (BMNH).

*Ptychandra lorquinii basilana* Fruhstorfer

(Text-fig. 7; Pl. 4, fig. 16)

*Ptychandra lorquinii basilana* Fruhstorfer, 1899 : 79; 1908 : 223; 1911 : 330, pl. 93, row g, second fig. LECTOTYPE ♀, PHILIPPINES: Bazilan (BMNH), here designated [examined]. [*Ptychandra caerulans* Fruhstorfer; Fruhstorfer, 1911 : pl. 93, row g, first fig. Mislabelled.] *Ptychandra lorquinii* var. *basilana* Fruhstorfer; Gaede, 1931 : 320.

DESCRIPTION. ♂. Forewing length 25.0-27.4 mm, n = 6. *Facies*. As in *lorquinii plateni*. *Genitalia*. Similar to those of *lorquinii plateni* but with apex of gnathos less broadened, less reflexed and with a few but more prominent dorsal teeth (Text-fig. 7).

♀. Forewing length 27.8-30.1 mm, n = 3. *Facies*. Forewing postdiscal white band constricted or broken in cell  $M_3$  with slight interruptions produced by dusting of black scales along  $M_3$  and  $CuA_1$ . Otherwise similar to *lorquinii plateni*. Forewing submarginal ocellus in cell  $M_3$  weakly displaced outwardly (0.1-0.7 mm,  $\bar{x}$  = 0.30 mm, n = 4). Outer mid-brown band on hindwing costal ocellus 0.3-0.6 mm,  $\bar{x}$  = 0.48 mm, n = 4.

DISTRIBUTION. Bazilan.

BIOLOGY. Not recorded.

## MATERIAL EXAMINED.

*Ptychandra lorquinii basilana*, lectotype ♀, BAZILAN, ii-iii. 98 (*Doherty*) (BMNH). 4 ♂, 2 ♀ paralectotypes, BAZILAN, ii-iii. 98 (*Doherty*) (BMNH); 1 ♂ paralectotype, BAZILAN ii-iii. 98 (*Doherty*) (CM).

BAZILAN: 16 ♂ (BMNH); 1 ♂ (*C. J. Grist*) (BMNH).

*Ptychandra lorquinii leytensis* subsp. n.

(Text-fig. 14; Pl. 4, fig. 17)

DESCRIPTION. ♂. Forewing length 26.9-27.2 mm. *Facies*. Slightly larger than nomino-

typical form and more boldly marked. Upperside markings as in *lorquini* *lorquini* but with distinct, pale blue-white marginal line on upperside hindwing. Forewing brand type (a) (Pl. 1, fig. 1) but with mealy scales beneath the hair pencil much reduced or absent. Underside with dull silver streaking but otherwise markings as in *plateni*. *Genitalia*. Similar to those of *lorquini* *plateni*, except gnathos less strongly hooked and dorsal teeth on it weakly developed (see Text-fig. 14).

♀. Forewing length 28.7–30.4 mm. *Facies*. White markings resemble those of *lorquini* *bazilana* but with pinkish tinge in white forewing postdiscal band and no dusting of black scales along  $CuA_1$  and  $M_3$ . Ground colour of upperside dark chocolate brown. Forewing submarginal ocellus in cell  $M_3$  displaced outwardly. Hindwing costal ocellus, outer mid-brown ring broad (0.8–1.1 mm,  $\bar{x}$  = 1.0 mm,  $n$  = 6).

DISTRIBUTION. Leyte.

BIOLOGY. Found quite commonly in forest clearings up to 700 m (*J. N. Jumalon*, personal communication).

DISCUSSION. This subspecies is distinguished in the female from other *lorquini* by the different shade of brown markings. The white markings can be regarded as transitional between the nominotypical species of Luzon and *lorquini* *plateni* from Mindanao. The male is similarly intermediate, having the larger size of the Mindanao form with the usually more bold markings of the Luzon race. The forewing brand is distinctive with its reduced mealy scaling below the hair pencil.

#### MATERIAL EXAMINED.

Holotype ♂, LEYTE: Catamon, St Bernard, 800 ft, 6.vi.1967 (*O. Jumalon*) (BMNH).

Paratypes. LEYTE: Catamon, St Bernard, 3 ♂, 6, vi., 6.xi.1967 (*O. Jumalon*) (BMNH); Lake Danao, Ormoc, 1 ♀, 29.ix.1963 (*J. N. Jumalon*) (BMNH); Lower Tangunan, Ormoc, 1 ♀, 21.xi.1963 (*J. N. Jumalon*) (BMNH); Tungunan Hot Springs, Cananga, 2 ♂, 20.xi.1966 (*J. N. Jumalon*) (BMNH).

Non-paratypic material. LEYTE: Catamon, St Bernard, 1 ♂, 1 ♀, vi. 1967 (*J. N. Jumalon*) (BMNH); Lake Danao, Ormoc, 1 ♂ (*J. N. Jumalon*) (BMNH); Ormoc, 2 ♂, 10.viii.1965, 10.xi.1965 (*J. N. Jumalon*) (BMNH); Ormoc, 1 ♂, 1 ♀, (*C. G. Treadaway*) (BMNH); Ormoc, 1 ♂, 3.x.1965 (*J. N. Jumalon*) (BMNH); Tungunan Hot Springs, 2 ♂, 1 ♀, 17.xi.1968, xi. 1966, (*J. N. Jumalon*) (BMNH); West Leyte, 1 ♂, xi. 1966 (*J. N. Jumalon*) (BMNH).

#### *Ptychandra lorquini* subspp. incertae sedis

Occasional specimens of *lorquini* have been seen from Palawan, Bohol, Panay and Samar. The Palawan specimens, all of which are males, are not distinguishable from *lorquini* *plateni* except biometrically (see biometric section). The lower discocellular vein on forewing of *lorquini* *bazilana* is significantly shorter than from the Palawan specimens and they are distinct from the Luzon specimens. The male specimens from Panay and Samar closely resemble *lorquini* *leytensis* in their prominent white upperside markings, relatively broad hindwings and

strongly coloured undersides with dull silver streaking. The female specimens from Bohol (see Pl. 4, fig. 18) and Samar closely resemble *lorquinii plateni* and *lorquinii leytensis* in patterning, particularly in having a similar subapical white band and similarly ringed ocelli. When a longer series of these insects has been taken from these islands it is likely that subspecific differences will become apparent.

#### MATERIAL EXAMINED.

BOHOL: 1 ♀ (SMN). PALAWAN: 1 ♂ (*Platen*) (BMNH); 1 ♂ (BMNH). PANAY: Yiollo, 1 ♂, iv. 28 (USNM). SAMAR: Antiago Valley, 1 ♀ (*J. J. Mounsey*) (BMNH); 1 ♂, vii-viii. 1896 (*J. Whitehead*) (BMNH).

### *Ptychandra schadenbergi* Semper

(Text-figs 3a, b, 11, 12; Pl. 2, fig. 4; Pl. 3, fig. 8; Pl. 4, figs 19, 20)

*Ptychandra schadenbergi* Semper, 1886 : 59, pl. 11, fig 6; Reuter, 1897 : 122; Fruhstorfer, 1899 : 80; 1908 : 222; 1911 : 329, pl. 93, row g, third fig.; Gaede, 1931 : 320; Hobby, 1940 : 220; Lewis, 1973 : 276, pl. 172, fig. 2. LECTOTYPE ♂, PHILIPPINES: North Mindanao (SMN), here designated [examined].

*Ptychandra schadenbergi* f. *hebetatrix* Fruhstorfer, 1908 : 222; 1911 : 329; Gaede, 1931 : 320. LECTOTYPE ♀, PHILIPPINES: Mindanao (BMNH), here designated [examined].

DESCRIPTION. ♂. Forewing length 23.2-26.7 mm, n = 23. *Facies*. Upperside deep iridescent blue with prominent white submarginal chevrons and white apical fleck on forewing. Forewing ocelli in cells  $M_1$ ,  $M_2$  and  $M_3$  and those in  $M_2$  and  $M_3$  confluent. Fringes brown. Pouched hair pencil present in cell  $CuA_1$  forewing below cell containing long dark brown hairs and narrowly bordered with turquoise scales. Forewing subquadrate with maximum curvature distal of centre of costa. Hindwing outer margin evenly curved with well defined scalloping between veins. Hindwing tail on  $M_3$  short, straight, weakly hooked and terminated acutely. Underside ground colour brown with darker marbling. Hindwing with usual ocelli with white pupil ringed by black, dark brown, buff and dark brown. Hindwing hair pencil in cell absent but small patch of modified dark scales present close to origin of  $R_s$  in most specimens. *Antennae*. Rufous, darker dorsally, especially on club. Thin cream line ventrally extending from base to two-thirds length of antennae. *Genitalia* (Text-fig. 3a, b). Tip of uncus slightly concave (Text-fig. 11). Gnathi (Text-fig. 12) without dorsal teeth, becoming distinctly narrower just before terminal hook. Valves tending to have more than one main terminal process.

♀. Forewing length 25.7-28.8 mm, n = 9. *Facies*. Upperside mid-brown with white markings. Wing shape similar to male. Forewing with rhomboidal white subapical fleck on costa, white submarginal ocellar spot in cell  $M_2$ , white postdiscal band running from costa towards spot in cell  $M_2$ . White discal patch bounded on inner margin by brown, never meeting this edge. Hindwing discal area white, bounded outwardly by brown, inward of the ocellar area. Ocelli sometimes faintly visible on upperside hindwing, particularly in cell  $CuA_2$ . White markings on underside as upperside but traversed by wavy brown thin bands in discal area. Forewing with three conjoined ocelli in cells  $M_1$ ,  $M_2$  and  $M_3$ . Ocelli white pupilled, distinctively ringed in succession with black, dark brown, buff and dark brown. *Antennae*. Patterned as male.

DISTRIBUTION. Mindanao. One specimen each examined labelled Palawan and Luzon, possibly with locality in error.

BIOLOGY. Not recorded.



DISCUSSION. A female specimen of *leucogyne* was illustrated and described by Semper (1886) as the female of *schadenbergi*, although Semper had female specimens of *schadenbergi* in his collection dated before his published description (cf. 1 ♀, Sibulan, 1.xii.81) and possibly even from the same collector (the illustrated specimen was taken 16.xi.81 in Bataan). Using Semper's misidentified figure for comparison Fruhstorfer (1908) described *hebetatrix* as a wet-season form of *schadenbergi*, presuming Semper's less heavily brown shaded specimen to be the dry-season one. Female specimens of *P. schadenbergi* indeed vary considerably, particularly in the extent of brown colouration on the hindwing upperside and the size of the forewing white markings. Specimens have been seen in which the hindwing discal area is pure white and others in which brown dusting invades considerably into the discal area past the ocellar ring. The holotype of *hebetatrix* is intermediate between these extremes of variation. Data to hand are insufficient to correlate this variation with seasonal conditions.

#### MATERIAL EXAMINED.

*Ptychandra schadenbergi*, lectotype ♂, MINDANAO, coll. C. Semper 'Typus SMFL 19' (SMN); 1 ♂ paralectotype, MINDANAO: N. (SMN); 3 ♂ paralectotypes, MINDANAO: N. (BMNH). *Ptychandra schadenbergi* f. *hebetatrix*, lectotype ♀, MINDANAO (BMNH).

MINDANAO: Baracata, Davao, 1 ♂, xii. 1922 (*F. Grinnell*) (BMNH); Calumbogan, 2 ♂, 1 ♀, vii-viii. 1917 (CM); Davao, 1 ♂, 1889 (*Platen*) (MNHU); Davao, 2 ♀ (*Platen*) (BMNH); Davao, 1 ♂, 1 ♀, iii. 1890, (BMNH); Davao, 1 ♂, 1 ♂, 5.v.1962 (*C. G. Treadaway*) (BMNH); Sibulan, 1 ♂, 3.i.82 (BMNH); Sibulan, 1 ♀, 1.xii.82, (SMN); Talaud, Malita, Davao, 1 ♂, 13.vi.61 (*J. M. Jumalon*) (BMNH); N. Mindanao, 2 ♂ (BMNH); N. Mindanao, 1 ♀ (SMN); 3 ♂, 3 ♀ (*Platen*) (MNHU); N. Mindanao, 2 ♂, 1 ♀, 1903-1904 (*J. Waterstradt*) (BMNH); N. Mindanao, 2 ♂, 3 ♀, (BMNH); N. Mindanao, 2 ♀, 1920 (*C. J. Grist*) (BMNH). LUZON: 1 ♂, 1920 (*E. C. Brabant*) (BMNH). PALAWAN: 1 ♂ (BMNH).

#### *Ptychandra mindorana* Semper stat. rev.

(Text-figs 9, 10; Pl. 2, fig. 5; Pl. 3, fig. 10; Pl. 5, figs 21, 22)

*Ptychandra mindorana* Semper, 1892 : 329. LECTOTYPE ♂, PHILIPPINES: Mindoro (SMN), here designated [examined].

*Ptychandra lorquinii mindorana* Semper; Fruhstorfer, 1899 : 80; 1908 : 223; 1911 : 330.

*Ptychandra lorquinii* var. *mindorana* Semper; Gaede, 1931 : 320.

DESCRIPTION. ♂. Forewing length 25.9-27.7 mm, n = 4. *Facies*. Forewing strongly convex distal of centre of costa. Scalloped appearance given to outer margins by long prominent white cilia interrupted at vein ends by dark brown ones. White chevrons and subapical fleck well marked. Forewing brand of type (b) (Pl. 2, fig. 5) with pouched hair pencil containing long mid-brown hairs. Pale elliptical source area for hair pencil elongate (3 mm × 1 mm). Hindwing margin rounded, evenly scalloped in cells *CuA*<sub>1</sub>, *CuA*<sub>2</sub>, *M*<sub>2</sub>, and *M*<sub>3</sub>. Tail at *M*<sub>3</sub> not hooked and poorly developed. Underside dark brown streaked with deep brown and prominent metallic silvery blue lines in discal area. Full series of ocelli on hindwing, edged inwardly and marginally by diffuse pale metallic blue band and with those in cells *M*<sub>1</sub> and *M*<sub>2</sub> confluent, that in cell *M*<sub>2</sub> inwardly displaced. Ocelli white-pupilled, ringed with black, light

brown, buff and dark brown; the light brown and buff bands separated by a thin black line, the buff band being broadened distally. *Antennae*. Club tip rufous with base dark brown. Dorsal scaling on shaft grey, extending into club. Ventrally rufous with pale flecks also invading club. *Genitalia*. Tip of uncus notched ventrally (Text-fig. 9).

♀. Forewing length 27.4–30.8 mm,  $n = 4$ . Upperside forewing evenly convex along costa, of mid-brown ground colour with cream-coloured markings. Postdiscal bar extending from half-way along costa to  $M_2$  and in line with a cream circular spot in cell  $M_2$  above the submarginal ocellus. Off-white discal patch extending from half-way along the lower discocellular vein towards tornus but not crossing vein  $1A + 2A$ . Fringes white interrupted with light brown at veins. Upperside hindwing discal area sandy brown becoming paler round costal ocellus. Hindwing margin rounded and evenly scalloped in cells  $1A + 2A$ ,  $CuA_1$ ,  $CuA_2$ , and  $M_3$ . Tail at  $M_3$  not hooked, bluntly terminated, short and narrow. Hindwing ocelli diffusely visible on upperside but with light brown rings in cells  $M_3$  and  $CuA_1$  prominent. Upperside cream areas reflected on underside. Forewing underside with three equal confluent ocelli in cells  $M_1$ ,  $M_2$  and  $M_3$ ; that in cell  $M_3$  inset. Hindwing cell  $R_s$  ocellus much enlarged, extending to  $M_2$  and inset. Cell  $M_2$  underside hindwing ocellus also inset and contiguous with that in cell  $M_1$ . Ocellus white-pupilled ringed with brown, light brown, buff and brown. *Antennae*. Similar to male.

DISTRIBUTION. Mindoro.

BIOLOGY. Said to fly in February (Semper, 1892).

DISCUSSION. Fruhstorfer (1911) treated *mindorana* as a subspecies of *lorquini* without comment. However, the differences from *lorquini* in secondary sexual characters and genitalia and wing shape lead us to consider it a separate species as originally described. The forewing brand closely resembles that of *leucogyne* except that the hair pencil has a more elliptical origin.

MATERIAL EXAMINED.

*Ptychandra mindorana* lectotype ♂, MINDORO: Paluan, 23.ii.89 (SMN); 1 ♀, paralectotype (SMN).

MINDORO: Calapan, 1 ♂, 1890–91 (*Platen*) (MNHU); Calapan, 1 ♂, 15.v.1956 (*J. N. Jumalon*) (BMNH); 2 ♂, 1 ♀ (BMNH); 2 ♀ (*Platen*) (MNHU); 3 ♂, 3 ♀ (*Platen*) (BMNH).

### *Ptychandra leucogyne* Felder & Felder stat. rev.

(Text-figs 4, 13; Pl. 1, fig. 2; Pl. 3, fig. 11; Pl. 5, fig. 23, 24)

*Ptychandra leucogyne* Felder & Felder, 1867 : 498; Fruhstorfer, 1899 : 81. LECTOTYPE

♀, 'HALMAHEIRA' (BMNH), here designated [examined].

[*Ptychandra schadenbergi* Semper, 1886 : 59–60, pl. 11, fig. 7. Misidentification in part.]

*Ptychandra lorquini leucogyne* Felder & Felder; Fruhstorfer, 1908 : 223; 1911 : 330.

*Ptychandra lorquini* var. *leucogyne* Felder & Felder; Gaede, 1931 : 320.

DESCRIPTION. ♂. Forewing length 24.2–25.1 mm,  $n = 4$ . *Facies*. Forewing costa weakly convex. Hindwing with slightly hooked tail on  $M_3$  with acute not rounded end. Hindwing margin tending to be quadrate not circular. Upperside deep iridescent blue, darkened narrowly at margin. Cilia dark brown on forewing and light brown interrupted by dark brown at veins on hindwing. White subapical fleck and faint, pale blue antemarginal chevrons variably present



on forewing. Forewing underside with four disjunct ocelli in cells *Rs* to *M*<sub>3</sub>, that in cell *Rs* sometimes reduced and that in cell *M*<sub>3</sub> inset. Brand and hair pencil, type (b) (Pl. 1, fig. 2). Small black hair pencil in hindwing cell close to origin of *Rs* (Pl. 5, fig. 11). White origin of forewing black hair pencil, 2 mm × 0.8 mm. Ocelli having white pupil ringed with black, light brown, buff, dark brown and fringed anteriorly and marginally with diffuse pale violet wavy line. *Antennae*. Club dark brown with rufous tip. Shaft with uniform grey-brown scales dorsally, rufous ventrally with paler flecks. *Genitalia*. Similar to those (Text-fig. 3) of *schadenbergi*, with serrated valve tips. Uncus with smooth unnotched tip. Gnathi smooth without dorsal teeth but narrowing distally and hooked.

♀. Forewing length 24.6–27.8 mm, n = 4. Upperside predominantly off-white, dusted variably with brown basad. White forewing discal area extends to inner margin and hindwing white discal area extends to costa. Maximum convexity of forewing at about halfway along costa. Hindwing subquadrate with hooked tail at *M*<sub>3</sub>, terminated acutely. Forewing costal and apical areas dark brown, broken by subapical white fleck, two-thirds distad on costa and postdiscal white bar running from half way along costa towards white submarginal spot in cell *M*<sub>2</sub>. Faint brown ocelli in cells *Rs* and *M*<sub>3</sub> on forewing upperside. Upperside hindwing off-white with light brown submarginal area sometimes extending just beyond submarginal ocelli which are diffuse brown ringed with buff. Forewing underside with four discrete or almost discrete ocelli in cells *Rs* to *M*<sub>3</sub>, that in cell *Rs* sometimes reduced and cell *M*<sub>3</sub> inwardly displaced. Ocellus in cell *M*<sub>1</sub>, forewing, white-pupilled, ringed with brown, light brown, buff and brown, others, especially in *M*<sub>2</sub>, more broadly white. Antemarginal lines dark brown, yellow-brown and dark brown and cilia light brown. *Antennae*. Similar to those of male.

**DISTRIBUTION.** Luzon, Samar, Negros, Cebu, Halmaheira. This is the only *Ptychandra* recorded from Cebu.

**BIOLOGY.** It has been observed (C. G. Treadaway, personal communication and specimens) that the two *Ptychandra* occurring on Luzon, *lorquini* and *leucogyne*, occupy different habitats. The more commonly taken species *lorquini* flies in secondary forest containing some primary areas while *leucogyne*, which is poorly represented in collections, occurs in glades in primary jungle. In the more commonly taken species males predominate but in *leucogyne* neither sex appears easily captured. This presumably reflects the more furtive habit of the latter species.

**DISCUSSION.** *P. leucogyne* has been confused with both *lorquini* and *schadenbergi*. The males closely resemble *lorquini* and occur with this subspecies on Luzon. They are separated by habitat and distinguished easily by the number of forewing ocelli and the presence or absence of a hindwing brand. The hindwing tail and cell are significantly shorter and the forewing hair pencil is longer. The female was described as that of *schadenbergi* by Semper but has a wing and tail shape more characteristic of *lorquini*. It may be conveniently distinguished from *schadenbergi* by the number of forewing ocelli and the extent of the white discal areas which in *leucogyne* reach to the inner margin of forewing and costa of the hindwing. Even strongly white-marked specimens of *schadenbergi* do not show this.

The wing scales of this species and *talboti* have a tendency to be multitoothed. In the hindwing subcostal ocellus, the area intensively studied, four and five pointed scales are normal but three pointed scales predominate in *lorquini* and *schadenbergi*.

The original description (Felder, 1867) is of a specimen said to be taken in Halmaheira by Lorquin, while Semper (1886) states that *leucogyne* flies on Batjan. However, the facies of the lectotype is within the range of variation observed for *leucogyne* from Luzon and no other specimen of *Ptychandra* examined, except the lectotype of *P. leucogyne*, has been labelled as taken in the North Moluccas. Furthermore, Boisduval (1868) reports that Lorquin, the collector of the lectotype specimen, left San Francisco in 1857 to go to Luzon where he stayed for two years. He also took ship, apparently the 'Novara', from Manila later when he visited Celebes and Halmaheira. Luzon is a reasonable locality for this species and it is noteworthy that the Felders (1867) described several species (e.g. *Ergolis luzonia*, *Charaxes amycus*, *Euripus clythia*) from Luzon taken by Lorquin in the same publication as the description of *leucogyne*. It is thus possible that the lectotype was taken in Luzon and not Halmaheira as described. Semper's record of the species from Batjan may have originated from the specimen actually of *leucogyne* but figured as ♀ *schadenbergi* (Semper, 1886) which was taken in Bataan, Luzon.

#### MATERIAL EXAMINED.

*Ptychandra leucogyne*, lectotype ♀, HALMAHEIRA (Lorquin) (BMNH).

LUZON: Bataan, 1 ♀, 16.xi.81, 'Paratypus SMFL 19b' (described as *P. schadenbergi*) (SMN); Los Baños, 1 ♀, vii. (*B. P. Clarke*) (USMN); Montalban, 1 ♀, 30.iv.1911 (*A. E. Wileman*) (BMNH); Mt Makiling, 1500 ft, 8 ♂, 20.xi.1955, 3.viii.1956, 31.viii.1966, 4.ix.1966 (*C. G. Treadaway*) (BMNH); Paete, 1 ♀, vi. (*B. P. Clarke*) (USNM); Tarlac 1 ♀ (*Browne*) (BMNH); 1 ♀ (BMNH). CEBU: Minglanilla, camp 7100 ft, 1 ♂, 1.x.1958, woodland (*J. N. Jumalon*) (BMNH). NEGROS: 1 ♂, lowlands, ii. 96 (*J. Whitehead*) (BMNH). SAMAR: Antiago Valley, 1 ♂ (*J. J. Mounsey*) (UM).

#### *Ptychandra talboti* Hobby stat. n.

(Text-figs 5a, b; Pl. 1, fig. 1; Pl. 3, fig. 9; Pl. 5, figs 25, 26)

*Ptychandra schadenbergi talboti* Hobby, 1940: 220, pl. 4, figs 1, 2. Holotype ♀, BORNEO: Sarawak, Mt Dulit (BMNH) [examined].

DESCRIPTION. ♂. Forewing length 19.1–20.8 mm,  $n = 4$ . *Facies*. Upperside deep iridescent blue-purple with narrow darkened margins. Cilia short and white, interrupted by brown at veins, giving scalloped appearance. Forewing costa strongly convex. Forewing brand and hair pencil of type (a) (Pl. 1, fig. 1). Hair pouch below  $CuA_1$  forewing absent. Hindwing quadrate, strongly excavate in cell  $M_2$  and weakly in cells  $M_3$ ,  $CuA_1$  and  $CuA_2$ . Tail at  $M_3$  weakly hooked and obtusely terminated. Hindwing with prominent black hair pencil (Pl. 3, fig. 9) arising in cell at base of  $R_s$  and lying across cell. Underside forewing with four submarginal ocelli in cells  $R_s$ – $M_3$ , with those in cells  $R_s$  and  $M_3$  slightly reduced. Costal ocellus of hindwing only slightly larger than remaining ocelli but inwardly displaced. Ocelli discrete with blue-white pupil ringed with black, mid-brown and dark brown and fringed incompletely, anteriorly and marginally with a faint mauve line. Marginal lines dark brown, light brown, dark brown and faint mauve. *Antennae*. Club slightly flattened, rufous, darker dorsally. Shaft black-scaled, with ventral white flecks basal to each segment. *Genitalia* (Text-fig. 5a). Gnathi toothless and weakly hooked at tip. Uncus smooth and rounded distally. Valvae without strongly sclerotized distal processes but with weakly toothed and serrated tips. Aedeagus (Text-fig. 5b) poorly developed, with only small areas of sclerotization.

♀. Forewing length 21.1 mm. *Facies*. Wing shape similar to male. Upperside forewing ground colour chocolate brown with white costal bar divided into three by darkened veins and extending to  $M_2$ . Subapical white fleck absent or vestigial. Discal white patch not extending to tornus but pointed distally. Submarginal white chevrons absent. Fringes dark brown. Hindwing discal area white, extending to costa and submarginal ocelli. Ocelli visible with eye spots of those in cells  $M_3$  and  $CuA_1$  sharply defined. Fringes greyish interrupted by smokey brown. Underside forewing costal band extending to  $M_3$ . Discal white patch as upperside. Four subequal submarginal ocelli in cells  $R_s$  to  $M_3$  in band sloping to tornus, fringed inwardly and marginally by a violet-tinged white band. Hindwing with full series of well defined ocelli with that in cell  $R_s$  enlarged and displaced inwardly. Discal area white, traversed by three much interrupted dark brown bands. Ocelli discrete, with white pupil ringed successively with dark brown, buff and mid-brown and externally fringed with diffuse white line. *Antennae*. Uniformly rufous except club darkened dorsally. Club slightly flattened.

DISTRIBUTION. Borneo.

BIOLOGY. Taken in or close to primary montane forest.

DISCUSSION. Only three female specimens ascribable to this species were examined. The female holotype from Mt Dulit was meticulously described by Hobby (1940). The specimens from Mt Kinabalu were considerably less brown dusted than the former, the brown marginal shading extending into the discal area beyond the submarginal ocelli in contrast to that of the Mt Dulit specimen in which it extends to halfway inward from the margin towards the submarginal ocelli. The Mt Kinabalu specimens also differed by having much paler discal areas on the underside with reduced brown banding and a slightly different hindwing shape, that of the holotype being more rounded with a less hooked tail and similar to that of *schadenbergi*. These differences are as extreme as the variation found within the series of female *schadenbergi* or *leucogyne* examined, but it may be that divergence to at least subspecific level has occurred on the Bornean mountains which will be revealed by examination of a longer series.

This species is considerably smaller than the Philippine *Ptychandra* and is thus distinguished from these biometrically by many of the parameters used. It superficially resembles *leucogyne*, particularly in general facies and possession of four forewing ocelli. It can be distinguished in the male by its size and secondary sexual characters, particularly the lack of the hair pouch below  $CuA_1$ . Despite the small size of this species, the forewing hair pencil is exceeded in length only by that of *mindorana*. In the female the white discal areas never reach the inner margin or costa, being margined by a brown area. In both sexes the forewing costa is markedly convex, not almost straight as in *leucogyne*. It is the only *Ptychandra* species to have four not five rings to the hindwing ocelli. The genitalia, particularly the aedeagus, differ considerably from those of other members of the genus. They are more delicate, less spiny structures and the aedeagus is reduced to a poorly defined chitinous fold.

MATERIAL EXAMINED.

*Ptychandra schadenbergi talboti*, holotype ♀, SARAWAK: 4600 ft, 17.x.32 (B. M. Hobby & A. W. Moore), moss forest, Oxford University Expedition (BMNH).



BORNEO: Mt Kinabalu, between 5500–6000 ft, 3 ♂, 1 ♀, 25.vii, 29.vii, 2.viii, 3.ix, 1965 (*H. J. Banks, H. S. Barlow & J. D. Holloway*) (BMNH); Mt Kinabalu, 5500 ft, 1 ♂, 1 ♀, 22, 24.iii.1974 (*Shoichi Iwanaga*) (Iwanaga coll., Osaka, Japan) (examined from colour photographs); Mt Trus Madi, 7800 ft, 1 ♂, 3.viii.1956 (BMNH).

*Ptychandra negrosensis* sp. n.

(Pl. 2; fig. 6; Pl. 3, fig. 12; Pl. 5, figs 27, 28)

DESCRIPTION. ♂. Forewing length 28.7 mm. *Facies*. Forewing slightly falcate with maximum convexity two-thirds distad on costa. Upperside deep iridescent blue with prominent broad rhomboidal white apical fleck, diffuse white antemarginal chevrons on forewing, appearing as pale blue wedge, broader apically, and white diffuse antemarginal line in hindwing. Small, purple ocellus in cell *CuA*<sub>2</sub>. Forewing hair pencil and brand structure type (c) (Pl. 2, fig. 6) with pouched hair pencil and white mealy scales in brand. Hindwing quadrate, prominently tailed at *M*<sub>3</sub> with excavation of cell *M*<sub>2</sub> much greater than of cell *M*<sub>3</sub>, producing a strong hook. Tail terminated bluntly. Prominent black hair pencil (4.6 mm) in cell at origin of *Rs* (Pl. 3, fig. 12). Underside forewing dark brown with lighter brown transverse wavy lines inwardly, ocelli in cells *M*<sub>1</sub>–*M*<sub>3</sub>, that in *M*<sub>1</sub> reduced. Antemarginal chevrons as upperside in shape, violet-tinged white, well-marked with prominent apical fleck. Slight metallic marbling in underside discal area. Full series of hindwing submarginal ocelli, with cell *Rs* ocellus inwardly displaced and much enlarged. Ocelli in cells *M*<sub>1</sub> and *M*<sub>2</sub> contiguous, others discrete; white pupilled ringed with mid-brown, light brown, buff and mid-brown lines and with diffuse violet band fringing ocelli, inward and marginally. *Antennae*. Club not well defined but with dark brown tip. Shaft grey dorsally, rufous exteriorly and paler ventrally. *Genitalia*. Gnathos smoothly curved distally with small dorsal spines extending about one-third of length. Uncus unnotched at end. Valves with two heavily toothed terminal processes similar to Text-fig. 2 but without middle process.

♀. Forewing, length 34.3 mm, not falcate. *Facies*. Upperside forewing brown with broad, white, entire subapical band running from half way along costa to anal angle. Subapical white fleck present. Hindwing prominently tailed at *M*<sub>3</sub> as in male. Upperside hindwing brown with dull brick red discal area. Two forewing ocelli in cells *M*<sub>1</sub> and *M*<sub>2</sub>, almost conjoined. Submarginal ocelli visible on upperside hindwing, particularly cells *M*<sub>2</sub> and *M*<sub>3</sub>, ringed with rusty brown and white pupilled. Underside discal area whitish with brown transverse wavy lines. White patch at costa distad of cell *Rs* ocellus, which is enlarged and displaced inwardly. Ocelli in hindwing cells *Rs* to *1A* + *2A* with white pupil ringed with mid-brown, light brown, buff and mid-brown lines and visible on upperside. Ocellus in cell *M*<sub>3</sub> displaced outwardly those in cells *M*<sub>1</sub> and *M*<sub>2</sub> contiguous.

DISTRIBUTION. Negros.

BIOLOGY. This species was taken in rain forest in a thick undergrowth of ferns and vines on an overcast day. It was feeding from cut grass stems in the company of amathusiids and *Neptis* species (*J. N. Jumalon*, personal communication).

DISCUSSION. This new species is easily distinguished from other *Ptychandra* by its large size. In the two specimens known the forewing ocellar band is reduced to two or one spot only. The prominent hindwing band distinguishes the male from other species while the female can be told by the very broad unbroken forewing subapical white band and the reddish discal area of the hindwing upperside. The

♂ genitalia are similar to those of southern *lorquini* and without a series for comparison cannot be confidently distinguished.

## MATERIAL EXAMINED.

Holotype ♂, NEGROS: Bayawan, x. 1963 (*J. N. Jumalon*) (BMNH).

Paratype (allotype) ♀, NEGROS: Bayawan, x. 1963 (*J. N. Jumalon*) (BMNH).

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